NUCLEAR SCIENCE ABSTRACTS

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GENERAL

Atomic Bombs and Warfare

7641 RM-1969(RAND)
RAND Corp., Santa Monica, Calif.
RADIOACTIVE CONTAMINATION FROM A MULTIBOMB CAMPAIGN. S. M. Greenfield. Jan. 6, 1956. 36p. (AD-123028).

The contamination that would result from a campaign involving many atomic or thermonuclear weapons detonated in a relatively limited area was computed. In theory it is possible to carry out such a calculation in a straightforward manner. That is, starting with the fallout pattern from one bomb, one can build up the results of campaigns of various types and sizes. It is apparent that for the results to be generally useful a large number of different combinations of wind structure, bomb size, aiming point, detonation point, area, etc., would have to be treated. Such a method would require a vast amount of detailed calculation. A statistical method is described that might adequately treat the problem if one is willing to make certain simplifying assumptions. The assumptions are that the bombs are dropped simultaneously, that they are all of the same yield, and that they are dropped at random within the given area. Various dosages and dose rates are calculated by means of a statistical method, and the results are presented graphically for a rather wide range of yields, areas, and numbers of bombs. Although some realism is removed by the assumptions, it is felt that these calculations will, at the very least, give an order-of-magnitude estimate of the contamination hazard from a multibomb campaign. (auth)

7642 USNRDL-TR-209
Naval Radiological Defense Lab., San Francisco.
THE COMPOSITIONS, STRUCTURES, AND ORIGINS OF RADIOACTIVE FALLOUT PARTICLES. C. E. Adams, N. H. Farlow, and W. R. Schell. Feb. 3, 1958. 47p.

The chemical compositions, structures and modes of origin of several different types of radioactive fallout particles have been determined through petrographic techniques, x-ray-diffraction analysis, radioautography, and specially prepared reagent films for liquid fallout. The fallout particles studied were collected following the detonation of nuclear weapons under various conditions at both the Nevada Test Site and the Eniwetok Proving Grounds. Radioactive fallout particles were formed by the interaction of the condensing vaporized metals and fission products derived from the bomb and associated structures with the surface material swept up into the cooling fireball. Descriptions of the various types of fallout particles are given and their modes of origin are qualitatively related by a simplified thermodynamic treatment. (auth)

Atomic Power

7643
NUCLEAR ENERGY IN THE GERMAN FEDERAL REPUBLIC. D. Cantarelli. Energia nucleare (Milan) 5, 165-8 (1958) Mar. (In Italian)

The German Federal Republic intends to follow its liberalistic economic program also in regard to nuclear problems. Its participation will most probably be limited to a compensation of surplus expenses involved in the installation of a nuclear power plant, with respect to an ordinary electrical generating plant construction. (auth)

7644
ECONOMICS OF NUCLEAR POWER. John E. Ullmann (Columbia Univ., New York). Science 127, 739-43(1958) Apr. 4.

An attempt is made to predict the time when nuclear power will begin to compete economically with power from conventional steam power plants. The two specific variables are capacity costs and bus-bar costs. The analysis is based on two premises: first, to apply the cost reduction rates of conventional steam power plants since 1910 to the rates of nuclear power; second, the instability of conventional power cost structure will lead to a considerable rise in cost. The trends from these two analyses are then combined to give a range of break-even points, beyond which nuclear power can compete. (W.D.M.)

BIOLOGY AND MEDICINE

7645 BNL-473
Brookhaven National Lab., Upton, N. Y.
QUARTERLY PROGRESS REPORT [FOR] JULY 1-SEPTEMBER 30, 1957. 56p. $1.75(OTS).

Progress in biology, chemistry, medicine, and physics research projects is briefly summarized. Accelerator development and operation is also reviewed. (For preceding period see BNL-455.) (D.E.B.)

7646 ORINS-22
Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
PROBLEMS IN THE ESTABLISHMENT OF A COLONY OF SPECIFIC-PATHOGEN-FREE RATS. Edgar A. Cress and Granvil C. Kyker. Dec. 1957. 19p. Contract AT-40-1-GEN-33. $0.75(OTS).

7647 UR-516
Rochester, N. Y. Univ. Atomic Energy Project.
THE UNRELIABILITY OF THE INTRA-PERITONEAL

INJECTION ROUTE AND THE VALIDITY OF EXPERIMENTAL OBSERVATIONS. R. C. Baxter and L. W. Tuttle. Jan. 9, 1958. 7p. Contract W-7401-eng-49. $0.50(OTS).

The intra-peritoneal injection method can be unreliable and lead to gross misinterpretation of experimental results which depend upon the adequacy of a single injection of radioisotope, drug or other pharmacologic agent. A method was devised by which the establishment of a given body burden of bone seeking radioisotope, Strontium-90 and Yttrium-90, in small laboratory animals was monitored daily by bremsstrahlen counts during the administration period. The use of this method permits the immediate detection of any aberrant individuals so that they may be given additional treatments to insure that all animals in the experiment have the same initial body burden. This equalization of body burden is of importance when long-term effects such as life span shortening and bone tumor incidence in relation to radiation dosage are of primary interest. In our series of 360 injections into 40 rats, partial or complete mis-injection of the isotope into the intestinal tract occurred on an average of 10% of the time and ranged from 0 to 17.5%. (auth)

7648 AEC-tr-3152

A METHOD FOR THE SEPARATION OF BONE MARROW CELLS BY MEANS OF MULTILAYER CENTRIFUGATION. Eiichi Kimura, Yoshikata Nishikawa, and Iwao Enomoto. Translated from Osaka Shiritsu Daigaku Igaku Zasshi 6, 234-40(1957). 14p.

A method is described by which the bone marrow elements are separated into fat cells, myeloid cells, and erythroid cells. The technique is devised on the difference in density among individual cells. It is based upon the separation of live leucocytes from whole blood by density-gradient centrifugation of gum acacia. (auth)

7649 AEC-tr-3173

BLOOD PLATELETS IN CANCER AND PEPTIC ULCER. A. A. Bagdasorov, R. I. Rodina, and E. G. Gefen. Translated by V. Rimsky-Korsakoff from Klin. Med. (U.S.S.R.) 28, 39-45(1950). 12p.

7650 AEC-tr-3180

COUNT OF THROMBOCYTES IN THE BLOOD. V. A. Andreev. Translated by V. Rimsky-Korsakoff from Klin. Med. (U.S.S.R.) 32, 68-72(1954). 5p.

Radiation Effects

7651 AF-SAM-57-153

Texas. Univ., Austin. Radiobiological Lab.

ACUTE AND CHRONIC EFFECTS FOLLOWING EXPOSURE TO A MIXED MEDIAN LETHAL DOSE OF FAST NEUTRONS AND GAMMA RAYS. Quentin L. Hartwig. June 27, 1957. 8p.

Three hundred sixty female Sprague-Dawley rats, three months old, were exposed in one hour to an acute dose of 320 rep of fast neutrons plus 110 r of gamma rays emanating from a uranium reactor. The exposure resulted in 57 percent fatalities within 30 days. Both the body and spleen weights of rats dying after the exposure were significantly less than those of the controls. However, only the spleen weight in animals dying on days 7 through 9 postexposure was significantly closer to normal range than the weight at its maximum low on day 5. Tumors began to appear in the irradiated group 69 days after the exposure in contrast to 146 days in the controls. By the 200th day postexposure, 23.6 percent of the irradiated group had tumors, compared with only 7.5 percent of the controls—a difference statistically significant to the 0.05 level. (auth)

7652 AFSWP-608

Armed Forces Special Weapons Project, Washington, D. C.

A SURVEY OF THEORIES AND EXPERIMENTS ON THE SHORTENING OF LIFE SPAN BY IONIZING RADIATION. Nathaniel I. Berlin and Frank L. DiMaggio. June 28, 1956. 65p.

The effect of total-body radiation, both acute and chronic, on life span has been reviewed from the standpoint of the Gompertz function, Sacher, Blair and Smith theories. The equations of Strandqvist, Hoffman and Reinhard, and the French EAW purporting to calculate the effective dose resulting from chronic irradiation have been reviewed. (auth)

7653 UR-509

Rochester, N. Y. Univ. Atomic Energy Project.

FURTHER STUDIES ON THE RELATIONSHIP BETWEEN EXPOSURE TIME AND DEPTH OF DAMAGE OF MODERATE AND SEVERE CUTANEOUS BURNS. F. W. Payne and J. R. Hinshaw. Oct. 31, 1957. 23p. Contract W-7401-eng-49. $0.75(OTS).

To extend our earlier studies on the relationship between exposure time and depth of damage of moderate and severe burns, injuries were produced by each of six radiant exposures delivered during varying exposure times. The exposures investigated were: 5, 8, 10, 13, 16, and 20 calories per square centimeter. Within this range, as the radiant exposure increased, the exposure time for the production of maximum damage also increased. Injury from a given radiant exposure was less with exposure times either longer or shorter than some intermediate time which led to the most severe injury. The relationship between steam bleb formation and decreased depth of injury from short exposure times is pointed out. When the superficial layers of the skin become so hot that vaporization of tissue fluid occurs, energy which might otherwise damage the deep layers is diverted by the conversion of water to steam. For radiant exposures between 8 cal/cm^2 and 20 cal/cm^2 delivered with a square pulse, it is possible to predict with fair accuracy the exposure time which will result in the deepest burn. (auth)

7654 UR-514

Rochester, N. Y. Univ. Atomic Energy Project.

HISTOLOGIC STUDIES OF THE EARLY HEALING PROCESS IN MODERATE SECOND DEGREE BURNS. F. W. Payne and J. R. Hinshaw. Dec. 12, 1957. 21p. Contract W-7401-eng-49. $0.75(OTS).

The sequence of the histologic changes which occur during the repair of moderate second degree skin burns was investigated. (C.H.)

7655

EFFECT OF X-IRRADIATION ON BOUND IRON AND UNSATURATED IRON-BINDING CAPACITY IN RABBITS. Thomas J. Haley, Anna M. Flesher, and Nathan Komesu (Univ. of California, Los Angeles). Am. J. Physiol. 192, 560-2(1958) Mar.

7656

EVIDENCE OF CIRCULATORY FAILURE IN THE EARLY RADIATION RESPONSE OF THE CHICKEN. S. P. Stearner, M. H. Sanderson, E. J. Christian, and A. M. Brues (Argonne National Lab., Lemont, Ill.). Am. J. Physiol. 192, 620-4(1958) Mar.

7657

ACETYLATION OF SULFANILAMIDE IN LIVING ANIMALS EXPOSED TO X-RAYS. E. F. Romantsev and Z. I. Zhulanova. Biochemistry (U.S.S.R.) 21, 685-8(1956) Nov.-Dec.

7658

EFFECT OF EXPOSURE TO RADIOACTIVE COBALT ON NUCLEIC ACID CONTENT IN SPLEEN TISSUES. N. V.

Luchnik (Ural Branch of the Academy of Sciences, USSR, Sverdlovsk). Biochemistry (U.S.S.R.) 21, 689-91(1956) Nov.-Dec.

7659

SURGICAL CASTRATION, LOCALIZED IRRADIATION WITH X RAYS AND DETERMINATION OF THE EXTERNAL SEXUAL CHARACTERISTICS IN THE FEMALE CRUSTACEA ISOPODA ASELLUS AQUATICUS L. Marie-Louise Balesdent-Marquet and André Veillet. Compt. rend. 246, 1753-6(1958) Mar. 17. (In French)

7660

THE EFFECT OF A SINGLE SYSTEMIC X-IRRADIATION OF THE C57BL MOUSE ON THE NUCLEODEPOLYMERASES OF THE THYMUS. Patricia P. Weymouth (Clarkson Coll. of Tech., Potsdam, N. Y.). Radiation Research 8, 307-21(1958) Apr.

7661

RELATIVE BIOLOGICAL EFFECTIVENESS OF ALPHA-RADIATION WITH THE BROAD BEAN ROOT (VICIA FABA) AS A TEST SYSTEM. J. F. Spalding, W. H. Langham, and E. C. Anderson (Los Alamos Scientific Lab., N. Mex.). Radiation Research 8, 322-8(1958) Apr.

Killing of the broad bean root was used as a test system to determine the relative effects of α-particles from radon and its daughters with Co^{60} and radium γ-radiation. The LD_{50} for γ-rays was 335.1 ± 11.0 rads, which was taken as unity. The LD_{50} dose of α-radiation was 56.9 ± 7.3 rads, which gives an RBE for α-particles of 5.82 ± 0.41. (auth)

7662

THE RELATION OF SURVIVAL TO RADIATION DOSE IN RUST FUNGI. E. A. Schwinghamer (Brookhaven National Lab., Upton, N. Y.). Radiation Research 8, 329-43(1958) Apr.

Radiation dose-survival evaluations were made for urediospores of four species of rust fungi exposed to x rays, γ rays, fast neutrons, thermal neutrons, and ultraviolet light. (C.H.)

7663

EFFECTS OF IONIZING RADIATION ON CROSS-REACTIVATION OF T1 BACTERIOPHAGE. J. E. Till and E. C. Pollard (Yale Univ., New Haven, Conn.). Radiation Research 8, 344-60(1958) Apr.

7664

LEUKEMIA IN HIROSHIMA CITY ATOMIC BOMB SURVIVORS. Niel Wald (Atomic Bomb Casualty Commission, Hiroshima). Science 127, 699-700(1958) Mar. 28.

An attempt is made to establish a quantitative relation between radiation-induced leukemia and the unit-dose of radiation received. Data are presented which are based on studies of the survivors of the atomic bombings in Hiroshima City, Japan. (C.H.)

7665

SYNERGISTIC ACTION OF ETHYLENEDIAMINETETRAACETATE AND RADIATION ON YEAST. W. J. Bair and F. P. Hungate (General Electric Co., Richland, Wash.). Science 127, 813(1958) Apr. 11.

7666

RADIATION SENSITIVITY OF EARLY EMBRYONIC STAGES OF DROSOPHILA MELANOGASTER. Hans R. Schinz and Hedi Fritz-Niggli (Radiotherapeutischen Klinik des Kantonsspitals, Zurich). Strahlentherapie 104, 328-37(1957). (In German)

7667

CONTRIBUTION ON THE SUBJECT OF "IMMUNIZATION" AGAINST EFFECTS OF IONIZING RADIATION. Liebknecht A. Dimitrow (Institut für Pathologische Physiologie der Universität Sofia, Bulgaria). Strahlentherapie 104, 436-41 (1957). (In German)

The results of successive irradiation of dogs have confirmed the conjecture that a considerable resistance against ionizing rays can be produced, with the suprarenal gland apparently playing the mere part of an intermediate link in the total reaction of the organism. Remarkable in this connection are Kiselew's communications concerning antibody formation posterior to irradiation with sublethal doses. (auth)

7668

INVESTIGATIONS OF RADIATION EFFECT ON MITOSIS. Adam Schreiber (Universität Bern, Germany). Strahlentherapie 105, 405-18(1958). (In German)

The development of the mitoserate-curve of the Ehrlich ascites-carcinoma of the white mouse after 31 Mev and 250 kev with 50, 100, 150, 250 and 300 r is examined; comparison curves and dose effect curves were worked out. Both sorts of radiations have the same quantitative effect on mitosis. In the recovery phase (the number of mitoses rising again) the effect of the betatron seems to be rather stronger; it is clear that the betatron effect on mitosis is at least not inferior to that of the conventional irradiations. As high voltage therapy proved less efficient for involution of the same solid tumor, a relatively more intense effect of betatron radiation on mitosis results. Examinations made with cysteine have shown that the ray protection effect of cysteine occurs above all in the recreation period and is more distinct under betatron irradiation than under conventional x irradiation. (auth)

7669

NUMBER OF EOSINOPHILIC LEUKOSITES IN THE PERIPHERAL BLOOD UNDER THE INFLUENCE OF HIGH-DOSAGE X RADIATION. Adolf Morczek and Irene Christoph (Universitäts-Röntgen-Institut, Leipzig). Strahlentherapie 105, 419-29(1958). (In German)

The number of eosinophile cells in the peripheral blood under different kinds of irradiation was determined by the modified method of Dunger. Results are presented graphically. (C.H.)

7670

PLASMA AND BLOOD VOLUME IN DOGS AFTER WHOLE-BODY X IRRADIATION WITH DOSES EXCEEDING LD_{50}. Vilmos Várterész, I. Fráter, E. Kálmán, and Béla Wald (Strahlenbiologischen Forschungsinstitut, Budapest). Strahlentherapie 105, 467-76(1958). (In German)

Radiation Hazards and Protection

7671 HASL-27

New York Operations Office. Health and Safety Lab., AEC. SOME VARIABLE CONTRIBUTORS TO NATURAL BACKGROUND. Keran O'Brien. Mar. 31, 1958. 8p. $1.80 (ph OTS); $1.80(mf OTS).

The effect on natural background gamma radiation from radon and its associated daughters in equilibrium and from potassium in fertilizers was calculated and found to be negligible. Background radiation intensities were assumed to be on the order of 10 μrad/hr. Dose rates from radon are 0.15 (μrad/hr)/(10^{-13} c/l) uniformly distributed in air, and 2.6 (μrad/hr)/(10^{-11} c/cm^2) at 3 ft above an infinite plane source. Dose rates from potassium carbonate are 1.3×10^{-4} (μrad/hr)/(lb K_2CO_3/acre) at 3 ft above an infinite plane source. (auth)

7672 HW-44526

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DECONTAMINATION OF PIG SKIN CONTAMINATED WITH A PLUTONIUM SOLUTION. L. A. George, Jr., N. L. Dockum, and L. K. Bustad. Aug. 20, 1956. 14p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Different methods of decontaminating plutonium contaminated skin were studied by contaminating localized areas of pig skin and then testing the different decontamination methods. Results indicate that the most effective of the decontamination methods tested involved the application of a plastic adherent material to the skin and its later removal by peeling. (auth)

7673 KIR-175/57

Norwegian Defence Research Establishment, Oslo. RADIOCHEMICAL ANALYSIS OF FALLOUT IN NORWAY. Monthly Communication No. 1. H. Bergh, G. Finstad, L. Lund, O. Michelsen, and B. Ottar. May 1957. 8p.

Data are tabulated on the concentration of radioactive iodine and strontium in samples of milk, and radioactive strontium and cesium in samples of drinking water collected in Norway, January to May 1957. (C.H.)

7674 KIR-176/57

Norwegian Defence Research Establishment, Oslo. RADIOCHEMICAL ANALYSIS OF FALL OUT IN NORWAY. Monthly Communication No. 2. H. Bergh, G. Finstad, L. Lund, O. Michelsen, and B. Ottar. June 1957. 9p.

Data are tabulated on the concentration of radioactive iodine and strontium in samples of milk, radioactive strontium and cesium in samples of drinking water, and radioactive strontium in tea and coffee preparations collected in Norway during May 1957. (C.H.)

7675 KIR-177/57

Norwegian Defence Research Establishment, Oslo. RADIOCHEMICAL ANALYSIS OF FALLOUT IN NORWAY. Monthly Communication No. 3. H. Bergh, G. Finstad, L. Lund, O. Michelsen, and B. Ottar. July 1957. 7p.

Data are tabulated on the concentration of radioactive iodine, strontium, and cesium in samples of milk and radioactive strontium and cesium in samples of drinking water collected in Norway during June 1957. (C.H.)

7676 KIR-183/57

Norwegian Defence Research Establishment, Olso. RADIOCHEMICAL ANALYSIS OF FALLOUT IN NORWAY. Monthly Communication No. 4. H. Bergh, G. Finstad, L. Lund, O. Michelsen, and B. Ottar. [Sept. 1957]. 9p.

Data are tabulated on the concentration of radioactive iodine, strontium, and cesium in samples of milk, radioactive strontium and cesium in samples of rain water, and radiocesium in preparations of tea and coffee collected in Norway during July and August 1957. (C.H.)

7677 KIR-186/57

Norwegian Defence Research Establishment, Oslo. RADIOCHEMICAL ANALYSIS OF FALLOUT IN NORWAY. Monthly Communication No. 5. H. Bergh, G. Finstad, L. Lund, O. Michelsen, and B. Ottar. Oct. 1957. 8p.

Data are tabulated on the concentration of radioactive iodine, strontium, and cesium in samples of milk collected in Norway in September 1957. Data are included from experiments on the purification of water contaminated with radioactive strontium and cesium. (C.H.)

7678 NAA-SR-Memo-406

North American Aviation, Inc., [Downey, Calif.]. WBNS SURVEY. R. L. Koontz. Sept. 5, 1952. Decl. Mar. 11, 1958. 11p. $3.30(ph OTS); $2.40(mf OTS).

The radiation levels which exist at 100 milliwatts for 8 hr/day operation meet the required maximum permissible dosage rates of 1/10 the AEC standard dosage rates. On this basis a safe level of operation is considered 1000 milliwatt hrs/day or 5.0 watts-hrs/week. A simple explanation for the required 1/10 of the AEC maximum permissible exposure rate is the simultaneous existence of three so-called tolerance dosage rates and an unknown summative effect of fast neutrons, slow neutrons, and gamma radiation. In addition, there are potential exposures from other sources of radiation in the laboratory. It has been shown that the radiation levels existing are below the AEC permissible rates in working areas for each of the separate types of radiation. No attempt has been made to summate the total exposure. If the WBNS is operated at the levels mentioned above, no harm to personnel in or around the WBNS should occur. (auth)

7679 NYO-4889

New York Operations Office. Health and Safety Lab., AEC. A STUDY OF FALLOUT IN RAINFALL COLLECTIONS FROM MARCH THROUGH JULY 1956. William R. Collins, Jr. and Naomi A. Hallden. Apr. 30, 1957. 27p. $4.80(ph OTS); $2.70(mf OTS).

A study of total β activity and radiostrontium in rain water was undertaken at HASL during the spring of 1956. At that time a survey of atmospheric aerosols and the elemental constituents of rainfall was being conducted. The samples from the network of stations were analyzed. Sampling covered the period from March through July 1956 for 61 stations within the continental United States, Bermuda, Newfoundland, and the Azores. The original purpose of the study at HASL was to correlate the amount of fall-out in rainfall with the estimate of total fall-out from gummed film measurements. (auth)

7680 UR-515

Rochester, N. Y. Univ. Atomic Energy Project. SUGGESTED URINARY TOLERANCE LEVELS FOR ENRICHED URANIUM. John B. Hursh. Dec. 26, 1957. 15p. Contract W-7401-eng-49. $0.50(OTS).

The animal experimentation basis for estimates of permissible levels of airborne, soluble, and insoluble natural uranium is briefly reviewed. It suggested that permissible air and urinary levels for enriched uranium be set at values equivalent to those for natural uranium in terms of disintegrations per minute per unit volume. An attempt is made to calculate the safety factors introduced by this procedure. (auth)

7681 UR-518

Rochester, N. Y. Univ. Atomic Energy Project. THE EFFECTS OF SOME LOCALLY APPLIED MEDICATIONS ON THE HEALING OF SECOND DEGREE BURNS. J. R. Hinshaw and H. E. Pearse. Jan. 15, 1958. 15p. Contract W-7401-eng-49. $0.50(OTS).

The possibility of evaluating experimentally the effects of locally applied medications on the rate of burn healing was explored. Twenty or 24 small burns were produced on each of eight anesthetized Chester White pigs by an exposure of 10 calories per square centimeter delivered in 3 seconds. In earlier studies it had been found that lesions from this exposure are moderate second degree burns which, if untreated, are completely covered with new epithelium in 14 days. Nine days after injury, less than half of them exhibit this degree of healing. The five medicated ointments tested were applied to randomized burns once a day for five days. After four days without treatment, the burns were biopsied. The degree of epithelial coverage was evaluated microscopically, and the results in treated and untreated areas were compared. None of the medications significantly promoted or delayed epithelial regeneration. Variations in healing rate from one animal to another and in different anatomical locations on the same animal were noted. These findings should affect the design of any experiment to determine the effects of treatment on healing. (auth)

7682 USNRDL-TR-207

Naval Radiological Defense Lab., San Francisco. MODIFICATION OF X-RADIATION LETHALITY BY AUTOLOGOUS MARROW INFUSION IN DOGS. E. L. Alpen and S. J. Baum. Feb. 26, 1958. 18p.

Dogs have been treated, after x-irradiation with doses of 400 r and 600 r, by injection of either homologous or autologous bone marrow. The bone marrow was obtained by pre-irradiation biopsy and was reinjected either into the animal from which it was drawn (autologous) or into an alternate recipient (homologous). Injection of 2×10^9 autologous nucleated cells successfully protected all dogs given either 400 r or 600 r. Dogs given 1×10^9 autologous nucleated cells after 600 r failed to survive. No protection was provided by injection of 2×10^9 homologous nucleated cells after 400 r nor by injection of 2×10^9 or 5×10^9 homologous nucleated cells after 600 r. It is proposed that a differential species sensitivity to foreign cell implants accounts for the failure of homologous marrow infusions in dogs in contradistinction to the protection provided by homologous or heterologous marrow implants in rats and mice, and by homologous implants in monkeys. (auth)

7683

HEMATOPOIETIC RECOVERY INDUCED BY BACTERIAL ENDOTOXIN IN IRRADIATED MICE. Willie W. Smith, Ilo M. Alderman, and Ruth E. Gillespie (National Institute of Health, Bethesda, Md.). Am. J. Physiol. 192, 549-56 (1958) Mar.

7684

NONSPECIFIC PROTECTIVE EFFECT OF SMALL LEAD SHIELDS AGAINST IRRADIATION DEATH IN THE RAT. David F. Bohr, P. A. Rondell, L. E. Palmer, and Frank H. Bethell (Univ. of Michigan, Ann Arbor). Am. J. Physiol. 193, 95-7(1958) Apr.

Rats subjected to 650 r whole-body irradiation were protected and to about equal extent by shielding either skin or muscle tissue. Shielding both tissues virtually doubled the protection. It is suggested that this ability to protect against the lethal effects of whole body irradiation is not necessarily related to the primary physiologic function of the shielded tissue, but may be a potentiality of any unirradiated cell. (auth)

7685

STRAIN DIFFERENCES IN RESPONSE TO WHOLE BODY IRRADIATION AND SHIELDING PROCEDURES IN THE RAT. David F. Bohr, C. Zippin, P. A. Rondell, and L. E. Palmer (Univ. of Michigan, Ann Arbor and Univ. of California, San Francisco). Am. J. Physiol. 193, 98-100(1958) Apr.

Over the past 3 years we have used 421 rats in studies of the protective effect of lead shields against irradiation death. Two strains of rats were used throughout these studies. The strain that was more sensitive to whole-body irradiation was also the one more effectively protected by the shielding procedure. Previous work indicated that shielded tissues made some contribution to the irradiated animal which enhances its chances of survival. From the current study it is concluded that the strain in which the tissues are best able to make this type of contribution is also the one in which this contribution is most readily destroyed by irradiation. (auth)

7686

A CALCULATION OF THE DOSE DUE TO INHALED RADON. L. S. Ruser. Atomnaya Energiya 4, 144-8(1958). (In Russian)

Calculations are made of radon doses inhaled under industrial and natural conditions. The analytical expression is given for the $A_\gamma(t)$ of Bi^{214} γ ray activity in inhaling process, and a method is offered for the evaluation of the mean coefficient of the retention of the short-life products in radon decay. Determination was made of the relation between the magnitude of the integral absorption dosage of Rn, Po^{218}, and Bi^{214}, and formulas are derived for the calculation of the dosage from the long-life products of radon decay. (tr-auth)

7687

EXPERIMENTAL PROBLEMS OF CHEMICAL RADIOPROTECTION. A. Herve and D. J. Mewissen. J. belge radiol. 41, 59-110(1958). (In French)

The possible radioprotective action of numerous substances (cyanide-group, amino-group, and lastly cysteamine and cystamine) has been studied by the method of «survival after lethal doses». A reproducible quantitative estimation of the protective action on limited animal series is thus obtained. Several of these substances were found to give a positive protective action against radiation which was remarkable in the case of cysteamine and cystamine. The peritoneal injection of cysteamine and cystamine increases the survival percentage of irradiated animals and cystamine is also effective when given by mouth. The protective action of cysteamine given by intraperitoneal injection and cystamine, given by mouth, was studied by analysis of probits in special conditions, namely, total irradiation by gamma radiations. The results show that the lethal effect can be statistically assimilated to the joint and independent action of at least two components. It presents certain modalities of the complex mechanisms of death by radiation and of the specific action of the chemical protectors. Moreover, cystamine given by mouth, during a prolonged time (a month or more) diminishes the radiotoxicity of injected P^{32}. The regression curves of the mortality probits studied, give useful precisions on the D.R.F. (dose-reduction factor). The D.R.F. of cysteamine and cystamine varies with the dose and these changes can be estimated from the regression-coefficients. Cysteamine and cystamine have a local protective action after segmental irradiation. (auth)

7688

SYMPOSIUM ON ANTIBODIES: THEIR PRODUCTION AND MECHANISM OF ACTION. Research Conference for Biology and Medicine of the Atomic Energy Commission, held at Gatlinburg, Tennessee, on April 8-10, 1957. J. Cellular Comp. Physiol. 50, Suppl. No. 1, 1-361(1957) Dec.

The stimulation of radiation recovery by bone marrow injections and the immunological background for the study of bone marrow transplantation in mammals are reviewed. (C.H.)

7689

THE MAXIMUM PERMISSIBLE INTAKE (M. P. I.) IN MILLIGRAMS AND MICROCURIES FOR DANGEROUS RADIONUCLIDES IN THE CHEMICAL INDUSTRY AND FOR A SINGLE EXPOSURE. Pierre-Octave Robert. J. phys. radium 18, Suppl. 12, 154A-7A(1957) Dec. (In French)

The maximum permissible intake in milligrams and millicuries is tabulated for the dangerous radioisotopes for different degrees and conditions of exposure. (J.S.R.)

7690

THE EFFECT OF CHOLESTERIN HYDROPEROXIDES ON X-IRRADIATED RATS. R. Koch (Univ. of Freiburg i. B. and Heiligenberg-Institutes, Baden, Germany). Naturwissenschaften 45, 134-5(1958).

To determine the effect of cholesterinhydroperoxide on irradiated rats, male rats weighing 120 to 140 g received a 4% suspension of Δ^6-cholesten-3β-ol-5α-hydroperoxide 4 days before whole-body irradiation. The rats received

from 250 to 650 r. Tabulation of the results shows that the drug has a definite protective effect. (J.S.R.)

7691

ON THE PROBLEM OF RADIATION PROTECTION FROM A MEDICAL VIEWPOINT. Hermann Holthusen. Strahlentherapie 104, 317-27(1957). (In German)

The dangers to which mankind is exposed through artificial radiation sources are discussed. Particular attention is paid to the charge of the human organism in consequence of medical application of rays, as well as to the importance of the international recommendations concerning the maximum admissible doses. The severe judgment of the dangers resulting from ionizing rays depends on the fact that the former conception of the existence of a threshold value of ray damage, and thus of a tolerance dose, had to be given up. The individual nature of the genetic ray damage entails a new kind of responsibility. (auth)

7692

RESEARCH ON A BIOLOGICAL PROTECTIVE SCREEN. PART XXI. FURTHER RESEARCH ON THE EFFECT OF CENTRAL NERVOUS SYSTEM STIMULATING AND DEPRESSING DRUGS ON THE RADIATION SENSITIVITY OF ANIMALS. Margarete Langendorff, Hans-Joachim Melching, Hanns Langendorff, Ruprecht Koch, and Roland Jaques (Universität Freiburg/Br., Heiligenberg-Instituts, Heiligenberg/Baden, Germany and CIBA A.-G., Basel). Strahlentherapie 104, 338-44(1957). (In German)

The protective effects of Resperin against radiation injuries in mice are evaluated. Results are compared with those obtained by treatment with Cysteamin, β-Aminoathylisothiuronium, Isophen (Pervitin), Caffein, Eventin (Cyclohexyl-isopropylmethylamin), Mescalin, and BOL-148. (C.H.)

7693

INVESTIGATION OF RADIATION DOSE IN THE LUNGS CAUSED BY RADON BEARING ATMOSPHERE. Karl Aurand, Ulrich Feine, Wolfgang Jacobi, and Alfred Schraub (Max Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 104, 345-54(1957). (In German)

The authors report on a method for appraising the tissue dose in the respiratory tract by decay products of radon. This appraisement is of importance with a view to the questions of the natural radiation exposure as well as to questions concerning the protection against irradiation in uranium mining. By aid of experiments with Th-B-marked aerosols, the question of resorption and of dispersion in the lungs is reported on. With autoradiographs of sections from the lungs of rats, the microscopic dispersion of Th-B-marked room-aerosols is shown. (auth)

7694

THE APPROPRIATE TREATMENT OF X-RAY DERMATITIS. Friedhelm Hess (Philipps-Universität, Marburg/Lahn, Germany). Strahlentherapie 105, 477-80(1958). (In German)

Radiation Sickness

7695

PATHOLOGY AND SYMPTOMATOLOGY OF THE RADIATION SYNDROME. (A Summarizing Report). Kurt Fochem (Universitäts-Frauenklinik, Vienna). Strahlentherapie 104, 416-35(1957). (In German)

The author gives a comprehensive synopsis of the irradiation syndrome. The different symptoms are detailed as regards to the time of their occurrence and of their intensity conditional upon the patients' age, type and degree of the affection. The theories regarding the mechanism of origin of the syndrome are discussed. In conjunction follows the assessment of investigations concerning the releasing factor of the acute irradiation disease. The differences between the kind of irradiation and the site of irradiation are pointed to. Finally, the therapeutic possibilities are discussed. (auth)

Radiotherapy

7696

OUTLINE OF PROBABLE WORLD REQUIREMENTS OF COBALT 60 FOR THERAPY MACHINES. R. F. Errington (Atomic Energy of Canada, Ltd.). Radiology 70, 481-5 (1958) Apr.

7697

A COMPARISON OF A COBALT-60 TELETHERAPY UNIT AND A 2-Mev VAN DE GRAAFF X-RAY GENERATOR ON THE BASIS OF PHYSICAL MEASUREMENTS. K. C. Tsien and Robert Robbins (Temple Univ., Philadelphia). Radiology 70, 486-502(1958) Apr.

7698

CRITICAL OBSERVATIONS ON CONTACT THERAPY WITH Co^{60} IN PARANASAL REGION. Kurt Ernst Scheer, Werner Schwab, and Werner Ey (Universität Heidelberg and Unversitäts-Hals-Nasen-Ohrenklinik Heidelberg). Strahlentherapie 104, 398-404(1957). (In German)

Cobalt^{60} contact therapy within a combined surgical-radiotherapeutical treatment is definitely indicated in the case of malignant tumors of the paranasal sinus, of the epipharynx, of the inner parts of the nose; malignant tumors of the tonsil, the floor of the mouth, the petros portion of the temporal bone, and the oesophage. The advantages and limits of the Co^{60} therapy are critically examined, the energy absorption displayed by the tissues being given particular consideration. (auth)

Toxicology Studies

7699 UR-508

Rochester, N. Y. Univ. Atomic Energy Project.
FATE OF INDIUM SESQUIOXIDE AND OF INDIUM^{114} TRICHLORIDE HYDROLYSATE FOLLOWING INHALATION IN RATS. P. E. Morrow, F. R. Gibb, R. Cloutier, L. J. Casarett, and J. K. Scott. Oct. 9, 1957. 33p. Contract W-7401-eng-49. $1.00(OTS).

Rats in groups of 2 or 3 were exposed to submicronic aerosols of indium sesquioxide (2.5 mg/M^3) and the hydrolysis products of indium^{114} trichloride (< 0.1 mg In/M^3) for periods of 30 to 180 minutes duration. The inhalation doses were invariably too low to permit toxicologic studies. Data are presented on the deposition and retention of the two indium preparations in the respiratory tract. Body burdens and urinary and fecal excretion rates were studied up to 14 days for the sesquioxide and up to 6 days for the In^{114} hydrolysate. Some tissue distribution data are presented which demonstrate small but significant absorption of indium particularly during the first 24 hours after either form is inhaled and that the absorbed indium is widely distributed with the greatest amounts going to the liver and kidney. Autoradiographic findings suggest the role of phagocytosis in lung clearance, an absence of systemic transport in particulate form and a concentration in compact bone. (auth)

7700 UR-519

Rochester, N. Y. Univ. Atomic Energy Project.
THE ACUTE TOXICITY AND RETENTION OF INTRAPERITONEALLY ADMINISTERED POLONIUM^{210} IN THE RAT. R. J. Della Rosa and J. N. Stannard. Jan. 22, 1958.

13p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40 (mf OTS).

Tracer Applications

7701
RADON ESCAPE FROM BONE MINERAL. R. E. Rowland, J. Jowsey, and J. H. Marshall (Argonne National Lab., Lemont, Ill.). Radiation Research 8, 298-306(1958) Apr.

In vitro, the retention of radon provides a sensitive measure of changes that take place in crystal sizes. Alcohol fixation and low-temperature embedding do not significantly change the radon retention of bone samples. In vivo, the recoil energy of the radon atom is usually sufficient to release it from its parent crystal, and, even though it may come to rest within an adjacent crystal, this does not necessarily prevent its subsequent escape. (auth)

CHEMISTRY

7702 HEC-85
Hooker Electrochemical Co., Niagara Falls, N. Y.
POTASSIUM FLUOBORATE PRODUCTION FROM BORON TRIFLUORIDE COMPLEXES CONTAINING METHYL BORATE. George T. Miller and Arthur M. Teller. Mar. 14, 1958. 7p. Contract AT(30-1)-1524. $1.80(ph OTS); $1.80(mf OTS).

Near quantitative yields of potassium fluoborate were realized by reacting potassium acid fluoride with dimethyl ether-boron trifluoride complex containing methyl borate-boron trifluoride complex. (auth)

7703 HW-43783(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EVALUATION OF HIGH Na_2O NEUTRALIZATION IN ACTIVATED SILICA PREPARATION. Final Report—DT-105-558-E. R. B. Richman. May 30, 1956. Decl. with deletions Nov. 4, 1957. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Treatment of Columbia River water with aluminum sulfate and activated silica to coagulate undesirable solids has been established as a satisfactory method for obtaining high-quality process water to cool Hanford reactors. The facility used for the preparation of activated silica was modified to permit continuous preparation of silica up to 96% neutralization. Performance characteristics and preparation of this high-neutralization silica are completely satisfactory. (W.L.H.)

7704 K-211
Carbide and Carbon Chemicals Corp. [K-25 Plant], Oak Ridge, Tenn.
BIBLIOGRAPHY ON PHOSPHATE SCALE REMOVAL. Fred E. Croxton, comp. May 12, 1948. 45p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

The references shown in this bibliography were collected in connection with the scale removal problem present in the K-25 plant cooling system. The removal of the phosphate type scale was emphasized, but various related problems are also treated. Many references concerning phosphates and removal methods were not included because the process would have necessitated the removal of the cooler unit, and fusion treatment with various salts. The bibliography is divided into three sections; Scale Removal, Phosphate Solubilization and Other Properties, and Analytical Techniques. The references listed were obtained from a search of Chemical Abstracts, 1917 to 1947, Industrial Arts Index, 1938 to 1948, and Engineering Index, 1946. (auth)

7705 RFP-80
Dow Chemical Co. Rocky Flats Plant, Denver.
DESTRUCTION OF CYANIDE WASTES BY ELECTROLYTIC CHLORINATION. J. T. Byrne, W. S. Turnley, and A. K. Williams. Sept. 16, 1957. 14p. Contract AT(29-1)-1106. $3.30(ph OTS); $2.40(mf OTS).

Cyanide wastes can be treated by saturating with NaCl and electrolytically generating chlorine within the waste solution. The cyanide is destroyed at the rate of 0.08 to 0.10 lb per kwh. The cost of raw materials (salt and powder) is relatively low, and laboratory tests indicate that virtually complete destruction of cyanide could be achieved at a significantly lower operating cost than by direct addition of chlorine gas or hypochlorites. In addition, most plating metals can be recovered on the cathode and there are no sludge disposal problems. (auth)

7706 WAPD-RM-158
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
SAFE PRACTICE IN THE HANDLING OF HYDROGEN. Z. M. Shapiro and R. H. Giffen. Dec. 4, 1952. Changed from OFFICIAL USE ONLY Jan. 10, 1958. 11p. $3.30 (ph OTS); $2.40(mf OTS).

Although the explosibility of hydrogen–air mixtures is well known, the concentrations and conditions under which hydrogen is safe and under which it becomes dangerous are not well known. This memo is written as a guide for users of hydrogen so that they may intelligently exercise necessary precautions. The memo is divided into two principle sections. The first is a general discussion relating to the flammability of hydrogen, and is designed to provide the reader with essential background information. The second section discusses specifically the precautions which are necessary for the safe handling of hydrogen. (auth)

7707 AEC-tr-2419
RESEARCHES ON THE MECHANISM OF THE ACTION OF ISONICOTINIC HYDRAZIDE: ITS RELATIONSHIP TO VITAMIN B_6. W. Caliari, S. Garattini, and A. Leonardi. Translated by Soliska R. Harris from Giorn. ital. chemioterap. 11, 32-40(1955). 18p.

7708 AEC-tr-2811
MOSCOW CONFERENCE ON PROBLEMS OF CHEMICAL KINETICS, CATALYSIS, AND REACTIVITY. N. M. Emanuel. Translated from Vestnik Akad. Nauk S.S.S.R. 25, 90-6(1955). 5p.

7709 AEC-tr-3187
CHEMISTRY OF COMPOUNDS WITH VARIABLE COMPOSITION. VI. THE TITANIUM–OXYGEN SYSTEM. S. M. Ariya, M. P. Morozova, and E. Vol'f. Translated by Michael Roman from Zhur. Neorg. Khim. 2, 13-22 (1957). 25p.

It is established that the enthalpy of the formation of the lower oxide of titanium in the domain of the $TiO_{1.00}-TiO_{1.22}$ composition appears as a linear function of the composition. At the same time, the enthalpy of formation of a lower oxide of titanium with a varied composition does not differ practically from the enthalpy of the formation of the TiO and Ti_2O_3 mixture of the same gross structures. The enthalpy of formation of the lower oxide of titanium in the domain of the $TiO_{1.00}-TiO_{0.89}$ composition likewise appears as a linear function of composition, but the angle of declination differs from the one in the first instance. The enthalpy of formation within the limits of the domain of homogeneity of $Ti-TiO_{0.40}$ appears as a linear function. At the same time the enthalpy of formation, applying to various com-

positions, confined to this domain, practically does not differ from the enthalpy of formation of a mixture of the gross-structure of metallic titanium and a lower oxide of titanium, the composition of which applies to the lower limit of the domain of homogeneity. A new model for the chemical structure of compounds with variable composition is offered. A change in the form of dependence of enthalpy of formation of a lower oxide of titanium on the composition appears at the point of the stoichiometric composition ($TiO_{1.00}$) in conformity with the general conditions. It is observed that the form of dependence of the enthalpy of formation on the composition can not change at the point of the stoichiometric composition in the case, when a new valence condition does not appear at that point. (auth)

Aerosols

7710

THE EFFECT OF ORGANIC VAPORS ON THE STABILITY OF AEROSOLS. Yoshiyasu Fujitani (Nagoya Univ., Japan). Bull. Chem. Soc. Japan 30, 683-9(1957) Oct.

The stabilities of aerosols depending on the nature of the added vapors as well as on their concentrations are discussed. The role of the vapors in stabilizing the aerosols and the rate of coagulation in the presence of such vapors were observed by means of the ultramicroscopic method using three kinds of aerosols, e.g., the fogs of aqueous ammonium chloride solution, glycerol, and dioctyl phthalate. (J.E.D.)

Analytical Procedures

7711 AEC-tr-2817

URANIUM CONCENTRATION OF RELATED ORGANS: HYPOPHYSIS, THYROID, GENERATIVE GLANDS, ADRENAL GLAND AND PANCREAS. Joseph Hoffmann. Translated from Biochem. Z. 315, 26-30(1943). 10p.

7712 AEC-tr-2818

CYTOCHEMICAL DEMONSTRATION OF THE POLYSACCHARIDES IN THE BLOOD CELLS AND IN THE HAEMOPOIETIC TISSUES. Fritz Heckner. Translated from Acta Haematol. 16, 1-10(1956). 15p.

7713 AEC-tr-2835

ON THE EXHALATION OF RADON FROM THE GROUND. G. Aliverti and G. Lovera. Translated from Ann. geofis. (Rome) 2, 137-41(1949). 6p.

7714

DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM IN PRESENCE OF HAFNIUM. Harry Freund and W. Floyd Holbrook (Bruceu of Mines, Albany). Anal. Chem. 30, 462-5(1958) Apr.

A differential spectrophotometric method of sufficient accuracy has been developed to permit the determination of zirconium in the presence of hafnium. By applying the Alizarin Red differential method of Manning and White to a fixed sum of hafnium oxide and zirconium oxide, it is possible to achieve this goal. The results are comparable in accuracy and precision to those obtainable by gravimetric methods. (auth)

7715

POLAROGRAPHIC DETERMINATION OF TIN IN ZIRCONIUM ALLOYS. John T. Porter II. (Knolls Atomic Power Lab., Schenectady, N. Y.). Anal. Chem. 30, 484-5(1958) Apr.

A method has been developed for determining tin in zirconium alloys polarographically. The procedure requires no separations from zirconium or the normally occurring alloy constituents. (auth)

7716

QUANTITATIVE DETERMINATION OF STRONTIUM-89 AND STRONTIUM-90 IN WATER. Jacob Kooi (Reactor Centrum Nederland, Hague). Anal. Chem. 30, 532-5(1958) Apr.

A simple procedure has been developed for the quantitative determination of radioactive strontium in water which may be rich in calcium. Sr^{89} and total radiostrontium may be obtained in about 5 hours, and Sr^{90} may be estimated by allowing the precipitate to stand overnight and separating Y^{90}. The sensitivity is better than one tenth of the internationally recommended maximum permissible concentration. The method is specific for strontium and suitable for large-scale, routine application. Radioactive barium may also be determined. (auth)

7717

ANALYTICAL REVIEWS. 1958 REVIEW OF FUNDAMENTAL DEVELOPMENTS IN ANALYSIS. Anal. Chem. 30, 553-872(1958) Apr.

The fundamental development in analysis, control, and instrumentation are reviewed. The subjects reviewed are light absorption spectrometry (602 references), infrared spectroscopy (827 references), x-ray absorption and emission (231 references), ultraviolet spectrophotometry (134 references), x-ray diffraction (41 references), emission spectroscopy (263 references), mass spectrometry (367 references), electroanalysis and coulometric analysis (16 references), chromatography: analysis by differential migration (188 references), distillation analysis (108 references), extraction (230 references), electron microscopy (327 references), amperometric titrations (114 references), organic polarography (489 references), polarographic theory, instrumentation, and methodology (170 references), ion exchange (179 references), nucleonics (1279 references), fluorometric analysis (196 references), instrumentation (61 references), statistical methods in chemistry (289 references), inorganic microchemistry (324 references), organic microchemistry (151 references), potentiometric titrations (242 references), gas analysis (349 references), acid-base titrations in nonaqueous solvents (233 references), inorganic gravimetric and volumetric analysis (114 references), volumetric and gravimetric analytical methods for organic compounds (167 references), chemical microscopy (460 references), nuclear magnetic resonance spectrometry (83 references), microbiological assays (285 references), and differential thermal analysis (135 references). (J.S.R.)

7718

PHOTOMETRIC DETERMINATION OF TANTALUM IN TITANIUM AND ITS ALLOYS BY MEANS OF ARSENAZO. E. I. Nikitina. Zhur. Anal. Khim. 13, 72-78(1958) Jan.-Feb. (In Russian)

Arsenazo forms with tantalum a soluble violet compound in strongly acid (mainly in hydrochloric acid) solutions. A tantalum-arsenazo complex is formed in tartrate and citrate solutions; it is stable on heating up to 100°. It has been established that the titanium-arsenazo complex is completely destroyed in strong hydrochloric acid solutions and does not interfere in the photocolorimetric determination of tantalum with arsenazo from its tartrate complex. A simple, fast, photocolorimetric method has been worked out for determining up to 15 % of tantalum in titanium alloys by means of arsenazo without the preliminary separation of titanium. (tr-auth)

7719

USE OF RADIOMETRIC METHODS FOR THE SIMULTANEOUS SEPARATE DETERMINATION OF URANIUM,

THORIUM, RADIUM AND POTASSIUM IN ACID IGNEOUS ROCKS. A. S. Serdyukova and Yu. T. Kapitanov (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 13, 88-94(1958) Jan.–Feb. (In Russian)

A method has been worked out for the simultaneous separate determination of U, Th, Ra, and K in acid igneous rocks. Samples of artificial mixtures have been investigated containing 6×10^{-4} % of U, 18×10^{-4} % of Th, 2×10^{-10} % of Ra, and 9 % of K (almost an order less than in Kidjurta granites). The results obtained were satisfactory. The successful application of the method depends on the correct choice of standards and consideration of all factors influencing measurement results. The determination can be carried out on any apparatus which is sensitive enough (a standard should be measurable with the content of radioactive elements being an order less than that in the samples to analyzed), and stable enough to secure coefficients persistence during a long time of measurements. (tr-auth)

7720

DETERMINATION OF URANIUM, THORIUM AND IONIUM IN SEA SILT. L. A. Kuzmina (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 13, 100-6(1958) Jan.–Feb. (In Russian)

A method has been developed for determining uranium, thorium, and ionium (Th^{230}) in sea silt from a single sample. The completeness of isolation and radiochemical purity of thorium isotopes have been tested by means of tracers. The method has been proved on samples of sea silt as well as of rocks, ores, and minerals. It is applicable at thorium content from 5×10^{-5} to $x \times 10^{-4}$ % when uranium content is $x \times 10^{-4}$ % and at uranium content up to 70 % when ionium content is $x \times 10^{-4}$ % (uranium equivalent). (tr-auth)

7721

A SPECTRAL METHOD FOR DETERMINING SMALL AMOUNTS OF LEAD, TIN, CADMIUM AND BISMUTH IN METALLIC RHENIUM. Yu. I. Kutsenko (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 13, 107-11(1958) Jan.–Feb. (In Russian)

A spectrochemical method has been developed for determining Cd, Bi, and Sb in metallic rhenium. The sensitivity of the method is 1×10^{-4} %. The accuracy is within 15 to 20 %. A spectral method has been suggested for determining Pb, Sn, Cd, Bi, and Sb in metallic rhenium with the sublimation of the basis. The sensitivity of the method is 2×10^{-4} % when Cd is determined and 1×10^{-4} % at the determination of Pb, Sn, Cd, Bi. The accuracy is within 15 to 20 %. The results of the analysis of metallic rhenium for Sb, Bi, and Cd obtained by both methods are in fairly good agreement. (tr-auth)

7722

SPECTROCHEMICAL DETERMINATION OF PLATINUM AND PALLADIUM IN URANIUM. O. I. Bufatin, A. N. Zaidel', and N. I. Kaliteevskii (A. A. Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 13, 116-18(1958) Jan.–Feb. (In Russian)

A method has been suggested for the determination of small amounts of platinum and palladium in uranium. Spectrochemical determinations follow the separation of elements to be determined by co-precipitation of platinum and palladium sulfides with copper. The method permits the quantitative determination of 10^{-4} % of Pt and 3.10^{-5} % of Pd in U. (tr-auth)

Fluorine and Fluorine Compounds

7723 ORNL-1702(Del.)

Oak Ridge National Lab., Tenn.

A SUMMARY OF DENSITY MEASUREMENTS ON MOLTEN FLUORIDE MIXTURES AND A CORRELATION FOR PREDICTING DENSITIES OF FLUORIDE MIXTURES. S. I. Cohen and T. N. Jones. July 19, 1954. Decl. with deletions Feb. 20, 1957. 36p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

A summary of all the experimental density measurements on molten fluoride mixtures that have been developed is given. A correlation of these data is presented which can be used to predict liquid densities of fluoride mixtures of known composition over wide, elevated temperature ranges. Experimental measurements were made by the buoyancy principle using a plummet suspended in the molten salts from an analytical balance, the entire system being enclosed in a dry-box. All the information available on compositions, experimental densities, melting points and cubical coefficients of expansion may be found in this report; calculated values of liquid and room temperature densities, molecular weights and molecular volumes of all the mixtures that have been developed for the ANP program are also presented. (auth)

Graphite

7724 HW-55531

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INFORMATION ON GRAPHITE BARS SENT TO THE UNITED KINGDOM. C. R. Richey. Mar. 31, 1958. 5p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Eight bars were selected and compared with the Hanford primary standard bars in the Hanford Test Pile. The results of the comparison are tabulated along with the weight of each bar. (A.C.)

7725 NP-6622

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

GRAPHITE TECHNOLOGY. Progress Report No. 5 for the Period December 1, 1957 to February 1, 1958. S. W. Bradstreet. Feb. 1, 1958. 23p. Project No. G-033. Contract AF33(616)-5185.

Experimental studies of graphite technology have resulted in several observations of some importance. Of these, two show that investigation and control of graphite manufacture can exploit the techniques of differential thermal analysis (for establishing binder reaction levels) and dynamic (sonic) methods for identifying changes in modulus with temperature without destruction of the specimen. The latter indicates that the threshold "creep" temperature for a typical dense graphite is between 2100 and 2550°C. Other observations include: a change in the rheology of pitch due to partial volatilization and oxidation at temperatures above 80°C, a decrease (for phenolic binders) in bloating during carbonization through preheating in vacuum, and accomplishment of pitch-bonded coke flour specimens having green densities above 1.75 gm/cc. (auth)

7726

CYCLOTRON RESONANCE IN GRAPHITE. Philippe Nozières (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 109, 1510-21(1958) Mar. 1.

The model of the bands recently proposed by Slonczewski and Weiss for graphite single crystals is described in some detail. It is then applied to a study of the cyclotron resonance absorption in graphite, taking into account plasma effects. This theory is then compared to the recent experimental data of Galt et al. The comparison leads to the conclusion that the charge carriers consist of holes with effective masses ranging from 0.066m to 0.054m, and

electrons with effective masses from 0.054m to 0. The present information on the band structure of graphite is gathered in the conclusion. (auth)

Laboratories and Equipment

Refer also to abstracts 7737, 8102, and 8231.

7727 BNL-3641
Brookhaven National Lab., Upton, N. Y.
SOME SAFETY RECOMMENDATIONS PERTINENT TO HOT LABORATORIES. L. C. Stang, Jr. [Mar. 1958]. 14p. Contract [AT-30-2-GEN-16]. $3.30(ph OTS); $2.40(mf OTS).

Presented at the Sixth Conference on Hot Laboratories and Equipment, Chicago, March 1958.

The explosions that occurred at the Brookhaven National Laboratory on May 15, 1957, are described. A detailed description is given of the behavior of the personnel during and following the explosion. An outline of the safety devices employed in the plant prior to the explosion, their location, and additional safety devices that were placed in the plant after the accident is given in detail. (W.L.H.)

Molecular Structure

7728 UCRL-8089
California. Univ., Berkeley. Radiation Lab.
STUDIES RELATING TO THE STRUCTURE OF ALUMINUM HYDRIDE (thesis). Robert F. Nickerson. Dec. 16, 1957. 93p. Contract W-7405-eng-48. $2.50(OTS).

The object of the work was to determine the molecular structure of AlH_3, using the techniques of "nuclear spin resonance." Attempts to prepare ether-free AlH_3 that were unsuccessful are described. Also it was not possible to observe the deuterium signal in AlD_3. It was possible, by the use of the proton signal of the ether in AlD_3, to obtain the nuclear spin resonance absorption curve for AlH_3 by subtracting out the contributions of the ether protons to the resonance signal. A model is proposed to explain the features of the nuclear spin resonance absorption curve. The existence of $LiAl_2H_7$, which has been postulated elsewhere, is assumed in order to explain the data obtained from high-resolution nuclear spin resonance experiments. (auth)

Radiation Chemistry

7729
RADIOLYSIS OF LIQUID METHANOL BY Co^{60} GAMMA-RADIATION. Gisuke Meshitsuka and Milton Burton (Univ. of Notre Dame, Ind.). Radiation Research 8, 285-97(1958) Apr.

Radiation Effects

Refer also to abstract 8229.

7730 IDO-16441
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
GAMMA DAMAGE TO ETHYLENE GLYCOL IN MTR 90-DAY COOLED FUEL ELEMENT SHIPMENT. F. R. Keller. Feb. 20, 1958. 3p. Contract AT(10-1)-205. $0.50(OTS).

A shipment of 90-day old spent MTR fuel elements was made in late November 1957 using ethylene glycol as an anti-freeze agent in the water surrounding the four elements within the shipping cask. Radiation damage to the ethylene glycol was apparent after five days in the cask. An oil phase and an aqueous phase were present in the liquid drained from the cask, and some gelatinous materi was observed on the fuel elements and the cask walls. As a consequence of this experience, the use of ethylene glyc as an anti-freeze has been discontinued in shipments of MTR fuel elements. (auth)

7731 WADC-TR-56-646(Pt. II)
California Research Corp., Richmond, Calif.
EFFECTS OF RADIATION ON AIRCRAFT LUBRICANTS AND FUELS. Summary Report No. 2 [for] December 1, 1956 to November 30, 1957. R. O. Bolt and J. G. Carroll. Jan. 31, 1958. 274p. Project title: RADIATION EFFECTS (MATERIALS). Contract AF33(616)-3184.

The objectives of the work reported included the development of radiation-resistant lubricants and a survey of the radiation stability of jet fuels. Aromatic base materials were needed in the lubricant work, and most of these had to be synthesized. Exploratory synthesis evolved alkaryl ethers, alkaryl esters, alkylbenzenes, alkyl diphenyl ethers and diarylalkanes. Chemical structure was correlated with physical properties and also with oxidation, thermal, and radiation stability. Although esters were inferior, each class had members with good radiation stability. Over-all, the alkyl diphenyl ethers offer the most promise for lubricant development. Polymers were also synthesized. These were used in an alkyl diphenyl ether to improve viscosity index and to increase viscosity. Compared to conventional thickeners, alkylated poly(α-methylstyrenes) (APAMS) and poly(alkylphenoxyethyl methacrylates) (APEMS) show promise for use in future radiation resistant lubricants. The grease research produced CALRESEARCH 159, a material of enhanced radiation stability. It is a selenide-inhibited alkylbiphenyl gelled with an aromatic salt. Promise of improved products was shown in work on new oils, e.g., tris(phenoxyphenyl)dodecylsilane; on new gelling agents, e.g., sodium N-p-tolylterephthalamate or mixtures of aromatic salts; and on new additives, e.g., N, N′-di-2-naphthyl-p-phenylenediamine. Many formulations of various hydraulic fluids were evaluated before and after irradiation. The alkyl diphenyl ethers looked best in radiation stability and in thermal stability at 700°F. CALRESEARCH 216 evolved from the formulation work. It is an alkyl diphenyl ether inhibited with a selenide and thickened with a polybutene. Chemical inhibitors improved oxidation stability both before and after gamma irradiation. Aromatic hydrocarbon additives in MLO 8200 fluid reduced viscosity change and gassing caused by irradiation. This fluid was shown to be usable to about 10^{10} ergs/g C of gamma radiation. Original and irradiated aromatic base fluids operated satisfactorily in aircraft piston pumps at 275°F. Isothermal bulk modulus was found to decrease markedly in a gas-liquid system such as would prevail under irradiation. The alkyl aromatics were found best as base materials for gas turbine oils. Esters, mineral oils, and polyglycols tested were deficient in radiation or thermal stability. CALRESEARCH 230 was developed in the work; it is a selenide-inhibited alkyl diphenyl ether containing a petroleum bright stock and other additives. The alkyl diphenyl ethers showed good oxidation stability before and after irradiation. Their tendency towards high coking and low lubricity was improved by additives. Irradiation lowered coking in these bases and also in alkylbiphenyls. In all base stocks, foaming increased after irradiation, with or without silicone being present. Coking was reduced by blending with high boiling materials, e.g., bright stocks. Certain oil soluble dyes showed synergism with the bene-

ficial dialkyl selenides in oxidation tests. The thermal stability of nine jet fuels (five JP-4's, three JP-5's, and an RP-1) was studied in the CFR coker. Original stocks and samples irradiated for three different levels were tested. Low level irradiation (0.8×10^{10} ergs/g C) impaired thermal stability. Higher level radiation (8×10^{10} ergs/g C) improved thermal stability. An equation was developed by which it was possible to predict increase in viscosity with irradiation at any dosage once a single dosage point was known. (auth)

Rare Earths and Rare-earth Compounds

7732

DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF RARE EARTHS. Charles V. Banks, John L. Spooner, and Jerome W. O'Laughlin (Iowa State Coll., Ames). Anal. Chem. 30, 458-62(1958) Apr.

Differential spectrophotometric methods are applied to the determination of neodymium–erbium, praseodymium–erbium, and praseodymium–neodymium–samarium mixtures with a standard deviation of 0.17% for analyses made by the "general" method and a standard deviation of 1.25% for analyses made by the "trace analysis" method. An accurate method of measuring small molar absorptivities is discussed. A statistical breakdown of the data obtained indicates optimum conditions may have to be determined experimentally rather than theoretically. (auth)

7733

USE OF C-300 SYNTHETIC RESIN FOR RARE EARTHS SEPARATION. E. Lazzarini, R. Somigliana, and E. Zamorani. Energia nucleare (Milan) 5, 199-202(1958) Mar.

The possibility of using C-300 ion-exchange resin for the separation of rare earths was investigated. Trivalent thulium, terbium, and europium were the ions used in the tests. From the results obtained it was concluded that the C-300 resin can be used for the separation. The rare earths can be collected in pure form with only one cycle of elution using eluent of pH 3.1, 3.2, or even 3.3, if the atomic numbers of the rare earths differ by a few units. (J.S.R.)

7734

THE SEPARATION OF RARE EARTHS WITH THE USE OF ETHYLENEDIAMINE-TETRAACETIC ACID. V. DIAGRAM OF SOLUBILITY NH_4(La-EDTA)–NH_4(Sm-EDTA)–H_2O AND K(La-EDTA)–K(Sm-EDTA)–H_2O AT 0°C. G. Brunisholz and R. Cahen. Helv. Chim. Acta 41, 188-94 (1958). (In French)

In the system NH_4[La-EDTA]–NH_4[Sm-EDTA]–H_2O (EDTA = ethylenediaminetetraacetate), two solid phases appear at 0°: the samarium-rich mixed crystals NH_4[(Sm, La)-EDTA], $8H_2O$ (= phase α) and the lanthanum-rich phase β (= NH_4[(La,Sm)-EDTA], n H_2O; n = probably 3). The solubility diagram shows two saturation curves; an important miscibility gap exists between the two phases. The system belongs to the type IV of the Roozeboom classification. Only one solid phase has been encountered in the system K[La-EDTA]–K[Sm-EDTA]–H_2O. It consists of the mixed crystals K[(La,Sm)-EDTA], $8H_2O$ with complete miscibility between La and Sm. As may be seen in the distribution diagram, a congruently saturated solution will probably exist at 0°C (with approx. 95 at.-g% Sm). Therefore this system should belong to Roozeboom's type III. (auth)

7735

SEPARATION OF RARE EARTHS WITH THE USE ETHYLENEDIAMINE-TETRAACETIC ACID. VI. THE SYSTEM NH_4(Gd-EDTA)–NH_4(Y-EDTA)–H_2O AT 0°C. G. Brunisholz and M. Randin (Univ. of Lausanne, Switzerland). Helv. Chim. Acta 41, 195-9(1958). (In French)

Two stable solid phases appear in the system NH_4[Gd-EDTA]–NH_4[Y-EDTA]–H_2O at 0°C: the gadolinium-rich octahydrate NH_4[(Gd,Y)-EDTA], $8H_2O$ (= phase α) and the yttrium-rich hexahydrate NH_4[(Y,Gd)-EDTA], $6H_2O$ (= phase η). An important miscibility gap exists between the two phases. The phase α gives easily metastable solutions which are supersaturated with regard to phase η. The system belongs to the type IV of the classification of Roozeboom. (auth)

7736

MAGNETIC MOMENTS AND APPARENT MOLECULAR FIELDS IN SOME RARE EARTH METALS AND COMPOUNDS. Warren E. Henry (U. S. Naval Research Lab., Washington). J. Appl. Phys. 29, 524-5(1958) Mar.

A study has been made of the absolute magnetization of some rare earth metals (gadolinium and cerium) and some compounds (ytterbium oxide, neodymium oxide, erbium oxide and yttrium iron garnet) as a function of magnetic fields up to 60,000 gauss and temperature down to 1.3°K. The saturation magnetization of ferromagnetic gadolinium is 7.05 ± 0.10 Bohr magneton per atom of gadolinium and its molecular field is 1.3 megagauss. The average magnetization of cerium is only 0.17 Bohr magneton per atom of cerium even at 1.3°K and 60,000 gauss. It is ferrimagnetic with an estimated antiferromagnetic molecular field of one-half megagauss. Ytterbium sesquioxide has an antiferromagnetic molecular field of about 35,000 gauss and becomes antiferromagnetic at about 3°K in zero field. Yttrium iron garnet (YIG) has been studied and the saturation magnetization has been determined at 100°K and in the helium range. The saturation magnetization is 0.83 at 1.3°K as compared with 1.25 Bohr magnetons per atom of iron in gamma iron(III) oxide studied previously. A ballistic method was used for measuring the magnetic moment and the calibration was made using metallic iron. (auth)

7737

SPECTROSCOPIC STUDIES ON RARE-EARTH COMPOUNDS. II. A COMPARATIVE STUDY OF THE ABSORPTION SPECTRA OF THE NEODYMIUM ION IN AQUEOUS SOLUTION AND IN CRYSTALLINE SALTS. P. Krumholz (Research Lab. of Orquima S.A., São Paulo, Brazil). Spectrochim. Acta 10, 274-80(1958) Jan.

The absorption spectra of aqueous solutions of neodymium perchlorate between 4000 A and 9000 A have been measured at 3° using a spectral bandwidth of 1 A. Several new bands and inflections are reported. A rather pronounced similarity was found between these spectra and the spectrum of crystalline neodymium bromate-enneahydrate. The absorbancy indexes of the principal absorption maxima of aqueous solutions of neodymium perchlorate were found to depend linearily on the reciprocal of the absolute temperature in the range between 3 and 60°. (auth)

7738

SPECTROSCOPIC STUDIES ON RARE-EARTH COMPOUNDS. I. INSTRUMENTATION. P. Krumholz (Research Lab. of Orquima S.A., São Paulo, Brazil). Spectrochim. Acta 10, 269-73(1958) Jan.

A grating spectrophotometer covering the range of 3600 to 9500 A with a spectral band width of less than 1 A, and showing excellent reproducibility of the wavelength setting is described. The instrument is provided with a simple device making blank readings nearly independent of the wavelength setting. (auth)

Separation Procedures

Refer also to abstract 8228.

7739 AECU-3641

Michigan. Univ., Ann Arbor.

NUCLEAR CHEMICAL RESEARCH; RADIOCHEMICAL SEPARATIONS AND ACTIVATION ANALYSIS. Progress Report No. 6 [for] November 1956–October 1957. Dept. of Chemistry. Nov. 1, 1957. 81p. Project No. 7. Contract AT(11-1)-70. $2.25(OTS).

The present facilities at the University of Michigan for research in nuclear chemistry are described. The determination of the cross sections of various (d,α) reactions induced by the 7.78 ± 0.05 Mev deuterons from the University of Michigan cyclotron is presented. The work on the absolute (d,α) reaction cross sections has been aimed at surveying the reaction yields as a function of atomic number with the hope of establishing the presence or absence of closed shell effects in these values. Methods are presented for the separation of carrier free P, Sc, Mn, Co, Y, and Nb. Work continued on the development and evaluation of radiochemical separation procedures for Ba, Sr, Ca, Ag, and In. A series of small-scale laboratory tests was conducted to determine the feasibility of the decontamination of I^{131} from air by means of adsorption on a highly efficient solid adsorber molecular sieve. Graphs are presented of atomic cross sections for thermal neutron activation of isotopes not found in nature vs. half life of daughter radioisotopes produced. (For preceding period see AECU-3375.) (W.L.H.)

7740 AECU-3660

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

KINETICS OF DISSOLUTION OF UO_2 IN SULFURIC ACID. Technical Report No. XXVIII. Theron L. Mackay and Milton E. Wadsworth. Sept. 15, 1957. 44p. Project No. 1. Contract AT(11-1)-82. $7.80(ph OTS); $3.30(mf OTS).

The leaching of UO_2 in sulfuric acid solutions was investigated and the rate of leaching was measured by determining the concentration of UO_2^{++} in solution as a function of time. The rate was determined as a function of the agitation of the solution, acid concentration, and overpressure of oxygen. A mechanism was postulated that satisfied the experimental observations. The leaching of uranium was found to be linear over the range of time under all the conditions investigated, and the rate was observed to be directly proportional to the partial pressure of oxygen. The rate at various concentrations of ions was determined to be a function of the concentration of H^+ ions. Evidences are presented that a UO_2 site on the surface of UO_2 reacts with a molecule of water to form a hydroxyl complex which in turn can dissociate similar to an acid. The rate determining step was found to be the reaction between an oxygen molecule and a hydroxyl complex of uranium on the surface of UO_2. Calculations of the energy of activation for the over-all process using the arrhenius equation was found to be 18 kcal/mole. With this value it was estimated that one site for every 10 to 20 surface sites was active. (auth)

7741 CF-55-10-127

Oak Ridge National Lab., Tenn.

CAPITAL AND DIRECT AND INDIRECT OPERATING COST ESTIMATES FOR MILL FOR RECOVERING URANIUM FROM LOW-GRADE ORE WITH THE HIGGINS CONTINUOUS ION EXCHANGE CONTACTOR. Paul L. Robertson. Oct. 27, 1955. 76p. Contract [W-7405-eng-26]. $12.30(ph OTS); $4.50(mf OTS).

The capital and direct and indirect operating costs were estimated for erecting and operating mills of 220 and 440 tons of ore per day capacity. The ores considered contained 0.15 or 0.30% uranium. The processes considered included crushing, grinding, acid or carbonate leaching, and final recovery of the U_3O_8 in a Higgins ion exchange contactor with a 5 M NaCl, 1 M NaCl, 1 M NH_4NO_3, or 1 M $NaHCO_3$ strip. It is felt that all phases of this preliminary cost estimate have been given due and careful consideration with reference to requirements for a mill of this type. Further detailed information with reference to the construction and operation characteristics of the Higgins ion exchange contactor are given in ORNL reports 1907 and 1918. (auth)

7742 CF-58-3-85

Oak Ridge National Lab., Tenn.

ESTIMATE OF POTENTIAL FUEL REPROCESSING, REVISION NO. 22–PART A. J. W. Ullmann. Mar. 24, 1958. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The power and estimated reprocessing load is tabulated for existing and proposed US and UK built non-military reactors over 10 kev. (auth)

7743 DOW-8, DOW-9, and DOW-10

Dow Chemical Co. Great Western Div.. Pittsburg, Calif.

PROGRESS REPORTS FOR OCTOBER, NOVEMBER, DECEMBER 1948. R. H. Bailes. (DOW-8, Nov. 5. Changed from OFFICIAL USE ONLY Mar. 27, 1957. 24p.; DOW-9, Dec. 9. Decl. Dec. 8, 1955. 14p.; and DOW-10, Jan. 10. Decl. Dec. 28, 1955. 32p.) Contract AT-30-1-GEN-236. (DOW-8, $4.80(ph OTS); $2.70(mf OTS); DOW-9, $3.30(ph OTS); $2.40(mf OTS); and DOW-10, $6.30(ph OTS); $3.00(mf OTS).)

These three reports were issued separately, but are cataloged as a unit.

Research and development are reported on the recovery of U from phosphate-bearing materials. The oxidation state of commercial 35% phosphoric acid was studied by potentiometric and spectrophotometric means. Recovery of U from fluoride precipitate by leaching with a hot solution of sodium carbonate and an evaluation of metal-reducing agents are included. (W.L.H.)

7744 DOW-14, DOW-15, and DOW-16

Dow Chemical Co. Great Western Div., Pittsburg, Calif.

PROGRESS REPORT FOR APRIL, MAY, JUNE 1949. R. H. Bailes. (DOW-14, May 2. Changed from OFFICIAL USE ONLY Mar. 14, 1958; 24p.; DOW-15, May 26. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 38p.; and DOW-16, June 28. Decl. Dec. 28, 1955. 36p.) Contract AT-30-1-GEN-236. (DOW-14, $4.80(ph OTS); $2.70(mf OTS); DOW-15 and DOW-16, $6.30(ph OTS); $3.00(mf OTS) ea.)

These three reports were issued separately, but are cataloged as a unit.

Recovery of U from commercial 32% and 30% H_3PO_4 and the recovery of U_3O_8 from commercial 32% H_3PO_4 by means of anion exchange resins is described. The adsorption of V from commercial 32% and 30% H_3PO_4 is presented. Recovery of F_2 from the fluoride precipitate, precipitation of uranous phosphate from synthetic solutions, and the precipitation of U from H_3PO_4 with Sb are discussed. (W.L.H.)

7745 DOW-20 and DOW-21

Dow Chemical Co. Great Western Div., Pittsburg, Calif.

PROGRESS REPORTS FOR OCTOBER AND NOVEMBER 1949. R. H. Bailes. (DOW-20, Oct. 31. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 67p. and DOW-21, Nov. 30, Decl. Dec. 28, 1955. 69p.) Contract AT-30-1-GEN-236. $10.80(ph OTS); $3.90(mf OTS) ea.

These two reports were issued separately, but are cataloged as a unit.

Research is reported on the recovery of U from commercial phosphoric acid and carbonate leaches by ion exchange, coprecipitation with antimony oxide, and coprecipitation with fluoride. The recovery of V from commercial phosphoric acid by ion exchange is described. The determination of U by fluorimetric methods is included. (W.L.H.)

7746 DOW-22

Dow Chemical Co. Great Western Div., Pittsburg, Calif. URANIUM RECOVERY FROM LOW-GRADE ORES. Progress Report for December 1949. R. H. Bailes. Dec. 30, 1949. Decl. Dec. 8, 1955. 72p. Contract AT-30-1-GEN-236. $12.30(ph OTS); $4.50(mf OTS).

Research is reported on the recovery of uranium from commercial phosphoric acid by three methods: ion exchange, coprecipitation with antimony oxide, and coprecipitation with fluoride. Research progress on the recovery of uranium from superphosphate, triple superphosphate, and phosphate rock is indicated. Modifications in the method for the determination of uranium by the Model R Fluorimeter are reported. (auth)

7747 DOW-28, DOW-30, and DOW-31

Dow Chemical Co. Great Western Div., Pittsburg, Calif. URANIUM RECOVERY FROM LOW-GRADE ORES. Progress Reports for April, May, June 1950. R. H. Bailes. (DOW-28, May 3. Changed from OFFICIAL USE ONLY Mar. 14, 1956. 63p.; DOW-30, May 29. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 71p.; and DOW-31, June 28. Decl. Dec. 8, 1955. 62p.) Contract AT-30-1-GEN-236. (DOW-28, $10.80(ph OTS); $3.90(mf OTS); DOW-30, $13.80(ph OTS); $4.80(mf OTS); DOW-31, $10.80(ph OTS); $3.90(mf OTS).)

These three reports were issued separately, but are cataloged as a unit.

Research is reported on the recovery of U and V from industrial H_3PO_4 by ion exchange. Preliminary studies on the application of ion exchange to the recovery of U from various leach liquors are included. (auth)

7748 DOW-33, DOW-34, and DOW-35

Dow Chemical Co. Great Western Div., Pittsburgh, Calif. URANIUM RECOVERY FROM LOW-GRADE ORES. Progress Reports for July, August, September 1950. R. H. Bailes. (DOW-33, July 28. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 53p.; DOW-34, Sept. 1. Decl. Dec. 28, 1955. 63p.; and DOW-35, Sept. 29. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 60p.) Contract AT-30-1-GEN-236. (DOW-33, $9.30(ph OTS); $3.60(mf OTS); DOW-34 and DOW-35, $10.80(ph OTS); $3.90(mf OTS) ea.)

These three reports were issued separately, but are cataloged as a unit.

Research is reported on the recovery of U and V from industrial phosphoric acid by ion exchange. Preliminary studies on the application of ion exchange to the recovery of U and V from various leach liquors are included. (auth)

7749 DOW-37 and DOW-38

Dow Chemical Co. Great Western Div., Pittsburg, Calif. URANIUM RECOVERY FROM LOW-GRADE ORES. Progress Reports [for] October, November 1950. R. H. Bailes. (DOW-37, Nov. 10. 82p. and DOW-38, Dec. 1. 45p.) Decl. Mar. 17, 1958. Contract AT-30-1-GEN-236. (DOW-37, $13.80(ph OTS); $4.80(mf OTS) and DOW-38, $7.80(ph OTS); $3.30(mf OTS).)

These two reports were issued separately, but are cataloged as a unit.

Research is reported on the use of ion exchange resins to recover uranium and vanadium from industrial phosphoric acid. Studies on the application of ion exchange to the recovery of uranium and vanadium from various leach liquors are reported. Preliminary experiments dealing with the purification of uranium products by ion exchange are described. (J.E.D.)

7750 DOW-41

Dow Chemical Co. Great Western Div., Pittsburg, Calif. URANIUM RECOVERY FROM INDUSTRIAL PHOSPHORIC ACID. Progress Report [for] December 1950. R. H. Bailes. Dec. 29, 1950. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 35p. Contract AT-30-1-GEN-236. $6.30(ph OTS); $3.00(mf OTS).

Research is reported on the use of ion exchange resins to recover U and V from industrial phosphoric acid. (auth)

7751 DOW-42, DOW-44, and DOW-47

Dow Chemical Co. Western Div., Pittsburg, Calif. URANIUM RECOVERY FROM MISCELLANEOUS MATERIALS. Progress Reports for January, February, March 1951. R. H. Bailes. (DOW-42, Jan. 26. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 32p.; DOW-44, Feb. 28. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 33p.; and DOW-47, Mar. 30. Decl. Dec. 9, 1955. 24p.) Contract AT-30-1-GEN-236. (DOW-42 and DOW-44, $6.30(ph OTS); $3.00(mf OTS) ea. and DOW-47, $4.80 (ph OTS); $2.70(mf OTS).)

These three reports were issued separately, but are cataloged as a unit.

Studies on the application of ion exchange to the recovery of U and V from various leach liquors are reported. Research is reported on the use of ion exchange resins to purify U products. (auth)

7752 DOW-50, and DOW-53

Dow Chemical Co. Western Div., Pittsburgh, Calif. THE RECOVERY OF URANIUM FROM MISCELLANEOUS MATERIALS. Progress Reports [for] April, May 1951. R. H. Bailes. (DOW-50, May 8. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 32p. and DOW-53, June 1. Decl. Mar. 17, 1958. 19p.) Contract AT-30-1-GEN-236. (DOW-50, $6.30(ph OTS); $3.00(mf OTS) and DOW-53, $3.30(ph OTS); $2.40(mf OTS)).

These two reports were issued separately, but are cataloged as a unit.

Studies on the application of ion exchange to the recovery of uranium from various leach liquors are reported. (J.E.D.)

7753 DOW-51, DOW-54, and DOW-56

Dow Chemical Co. Western Div., Pittsburg, Calif. THE RECOVERY OF URANIUM FROM INDUSTRIAL PHOSPHORIC ACID. Progress Reports [for] April, May, June 1951. R. H. Bailes. (DOW-51, May 8. 62p.; DOW-54, June 6. 71p.; and DOW-56, June 29. 73p.) Changed from OFFICIAL USE ONLY Mar. 14, 1958. Contract AT-30-1-GEN-236. (DOW-51, $10.80(ph OTS); $3.90(mf OTS); and DOW-54 and DOW-56, $12.30(ph OTS); $4.50 (mf OTS) ea.)

These three reports were issued separately, but are cataloged as a unit.

Research is reported on the use of ion exchange resins and precipitation methods to recover U and V from industrial phosphoric acid from several sources. (auth)

7754 DOW-52 and DOW-52-A

Dow Chemical Co. Western Div., Pittsburg, Calif. A PILOT PLANT FOR THE RECOVERY OF URANIUM FROM INDUSTRIAL PHOSPHORIC ACID. [PART I]. Ray S. Long and James T. Mitchell. PART II. D. E. Garrett and G. R. Moore. Summary Status Report. (Pt. I, May

14, 1951. 167p. and Pt. II, Feb. 1, 1952. 151p.) Changed from OFFICIAL USE ONLY Mar. 14, 1958. Contract AT-30-1-GEN-236. (Pt. I, $25.80(ph OTS); $7.80(mf OTS) and Pt. II, $24.30(ph OTS); $7.50(mf OTS).)

These two parts were issued separately, but are cataloged as a unit.

The design and operation of a pilot plant for the recovery of U from industrial phosphoric acid are described. Included are recovery data, raw material requirements, problems encountered, and suggestions for future design. (auth)

7755 DOW-55

Dow Chemical Co. Western Div., Pittsburg, Calif.

THE RECOVERY OF URANIUM AND VANADIUM FROM MONTICELLO LEACH LIQUORS BY ION EXCHANGE. D. A. Ellis. Aug. 14, 1951. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 71p. Contract AT-30-1-GEN-236. $12.30(ph OTS); $4.50(mf OTS).

An ion-exchange process using Dowex 1 for the recovery of U and V from non-salt roast Monticello carbonate leach liquor is described. This method is inapplicable to salt-roast liquor. Experiments are reported on the use of Dowex 1 ion-exchange resin to upgrade precipitates obtained from Monticello leach liquor by NaOH addition or Na amalgam reduction. (W.L.H.)

7756 DOW-64

Dow Chemical Co. Western Div., Pittsburg, Calif.

THE RECOVERY OF URANIUM FROM INDUSTRIAL PHOSPHORIC ACID. Progress Report [for] November 1951. Research Dept. R. H. Bailes. Dec. 11, 1951. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 66p. Contract AT-30-1-GEN-236. $10.80(ph OTS); $3.90(mf OTS).

The use of alkyl acid phosphates in hydrocarbon diluents for the solvent extraction of U from industrial phosphoric acids and solid phosphatic materials is described. Experiments on the chemistry and mechanics of the solvent extraction processes have been performed. A process for recovery of U from a commercial phosphoric acid by precipitation with ammonia is discussed. The properties of new ion-exchange resins are detailed. (auth)

7757 DOW-73

Dow Chemical Co. Western Div., Pittsburg, Calif.

THE RECOVERY OF URANIUM FROM CANADIAN LEACH LIQUORS BY ION EXCHANGE. Summary Status Report. David A. Ellis, R. R. Grinstead, and Rosemary M. Ragen. Mar. 17, 1952. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 92p. Contract AT-30-1-GEN-236. $15.30 (ph OTS); $5.40(mf OTS).

Ion exchange methods were successfully applied to the recovery of U from four Canadian leach liquors. Two were received from Eldorado Mining and Refining Limited, one from Great Bear Lake, and one from Lake Athabaska. (auth)

7758 DOW-111

Dow Chemical Co. Western Div., Pittsburg, Calif.

RECOVERY OF URANIUM FROM PHOSPHATE ROCK DURING THE MANUFACTURE OF WET PROCESS PHOSPHORIC ACID. K. Glenn Shaw. Feb. 15, 1954. Changed from OFFICIAL USE ONLY Mar. 14, 1958. 20p. Contract AT-30-1-GEN-236. $4.80(ph OTS); $2.70(mf OTS).

The results of an investigation of the recovery of U into the acid phase during the manufacture of wet process phosphoric acid are reported. Several means of decreasing U losses to the gypsum are presented. (auth)

7759 ORNL-2450

Oak Ridge National Lab., Tenn.

SOME ASPECTS OF THE RECOVERY OF LITHIUM FROM SPODUMENE. G. D. White and T. N. McVay. Aug. 3, 1958. 14p. Contract W-7405-eng-26. $0.75(OTS).

The firing range for maximum lithium recovery from spodumene in the sulfuric acid roast process, properties of leached spodumene in this process, properties of products resulting from the calcining operation in the calcium carbonate process, and thermal effects of the calcining operation were investigated. The differences in the spodumenes from various North American locations were ascribed to the degree of interlocking between spodumene and impurities, since no definite differences appeared in the chemical composition or crystal structure. (J.R.D.)

7760 ORNL-2451

Oak Ridge National Lab., Tenn.

PROGRESS REPORT ON RAW MATERIALS FOR OCTOBER 1957. Chemical Technology Div. K. B. Brown, C. F. Coleman, D. J. Crouse, and A. D. Ryon. Feb. 13, 1958. 25p. Contract W-7405-eng-26. $0.75(OTS).

Systematic Studies. A series of experimental dilaurylpolypropoxy amines showed only fair uranium extraction power from dilute sulfate solution. There was little change in behavior with change in propoxy chain length from 1 to 6 units, except that only with the longest-chain sample were phase separations good. Loss of di(2-ethylhexyl)phosphoric acid (D2EHPA) from 0.1 M solution in kerosene to dilute acidic sulfate solutions, measured by distribution of P-32-labeled reagent, was <1 mg/liter of aqueous solution at 25°C and <5 mg/liter at 50°C. The corresponding losses to 10 M HCl solution were 1.5 and 5 mg/liter. On prolonged contact (100 hr) a small but measurably higher concentration of P-32 was found in the aqueous phase, which is attributed to slight (~0.01%) hydrolysis of the D2EHPA. In preliminary tests of cation exchange between sodium di(2-ethylhexyl)phosphate solutions in modified Amsco 123-15 and aqueous neutral-to-basic nitrate solutions, strontium was preferentially distributed to the organic phase, with Sr/Na separation factors of about 30. Cesium was extracted less than sodium. Process Development Studies. The inorganic phosphate content of a Dapex process vanadium(IV) strip solution was decreased sufficiently by passage through a zirconium oxide column to permit direct ammonia precipitation of a vanadium product meeting phosphorus specifications. Losses of zirconium to the strip solution were low. The phosphate was partially eluted from the column with dilute sodium hydroxide. Stripping rates of vanadium and contaminants from 0.25 M D2EHPA/kerosene with 1 M H_2SO_4 were compared at 25 and 50°C, in a study of the possibility of avoiding contaminant buildup by acid stripping alone. The stripping rates of vanadium(IV), aluminum, and especially iron(III) were markedly increased at the higher temperature. The rates were essentially the same with or without TBP (0.2 M) in the organic phase. Engineering Studies. Comparison of the rate of uranium extraction by Dapex solvent at aqueous to solvent ratios of 4/1 and 1/1 shows that the rate constants agree when adjusted for the fraction of aqueous phase present in the mixer. The stage efficiency of the mixer with continuous flow remained virtually unchanged when the aqueous flow rate was constant and the aqueous to solvent ratio in the mixer was changed from 4/1 to 1/1. Fundamental Studies. In continued study by infrared spectrophotometry of the molecular association between di(2-ethylhexyl)phosphoric acid (D2EHPA) and tri-n-octylphosphine oxide (TOPO) in n-octane, measurements of the dependence on TOPO concentration at constant D2EHPA concentrations indicated the existence of a 2(D2EHPA):(TOPO) complex, in addition to the (D2EHPA):(TOPO) complex previously reported. The data are well

fitted by values for the formation constants of K_1 = (D2EHPA·TOPO)/(D2EHPA$_2$)^{½}(TOPO) = 30 ± 5 and K_2 = (D2EHPA$_2$·TOPO)/(D2EHPA$_2$)(TOPO) = 100 ± 50. The concentration of D2EHPA$_2$·TOPO was much lower than that of D2EHPA·TOPO over most of the range of solutions examined. (For preceding period see ORNL-2443.) (auth)

7761 ORNL-2473

Oak Ridge National Lab., Tenn.

THOREX PROCESS: THIRD URANIUM CYCLE STUDIES. J. R. Oliver. Apr. 14, 1958. 16p. Contract W-7405-eng-26. $0.75(OTS).

Laboratory studies indicated that a Thorex third cycle uranyl nitrate feed containing 50 g of uranium per liter should be 0.70 M in $Al(NO_3)_3$ and 0.50 M in HNO_3; the scrub, 0.50 M in $Al(NO_3)_3$; the extractant, 10 vol. % tributyl phosphate (TBP) in Amsco; and the feed/scrub/extractant flow ratios, 1/0.3/1.5. With these conditions the uranium loss was 0.005 g/liter, or 0.01%, in laboratory tests. Decontamination factors were about 600 for ruthenium and 400 for zirconium–niobium. (auth)

7762 ORNL-2477

Oak Ridge National Lab., Tenn.

A SUMMARY OF THE SEPARATION OPERATIONS. M. E. Whatley. Apr. 11, 1958. 102p. Contract W-7405-eng-26. $2.75(OTS).

The subjects discussed are: chemical engineering systems, common concepts used in separation operation, distillation, gaseous diffusion, solvent extraction, and ion exchange. (W.L.H.)

7763 WIN-89

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

KINETICS OF THE DISSOLUTION OF URANIUM DIOXIDE IN CARBONATE–BICARBONATE SOLUTIONS. W. E. Schortmann and M. A. DeSesa. Mar. 12, 1958. 62p. Contract AT(49-6)-924. $10.80(ph OTS); $3.90(mf OTS).

The kinetics of the dissolution of uranium dioxide in sodium carbonate-sodium bicarbonate solutions were determined. The study was undertaken in order to obtain fundamental information about the commercial carbonate process for leaching uranium from its ores. A rate equation incorporating the effects of surface area, oxygen partial pressure, temperature, and reagent concentrations was empirically developed. A mechanism consisting essentially of two consecutive reactions at steady state is proposed. These reactions are the oxidation of U^{4+} to U^{6+} and the subsequent formation of the uranyl dicarbonate complex ion. Depending on the conditions, either or both of these reactions can determine the over-all rate. The conversion of uranyl dicarbonate to the uranyl tricarbonate complex ion is postulated to be very rapid. In the suggested mechanism, the rate-determining phase of the oxidation is the dissociation of adsorbed molecular oxygen, and both the carbonate and bicarbonate ions play equivalent roles in the formation of the uranyl dicarbonate. As indicated by their high activation energies of about 13 and 14 kcal per mole uranium, both reactions are chemical rather than diffusional processes. A mathematical examination of the proposed mechanism produced a rate equation consistent with the experimental information. The credibility of the mechanism was thereby strengthened. (auth)

7764 AEC-tr-2930

SEPARATION OF RARE EARTHS IN AQUEOUS SOLUTION BY IONIC MIGRATION. K. Clusius and E. R. Ramirez. Translated from Helv. Chim. Acta, 36, 1160-5(1953). 8p.

An apparatus is described for the separation of rare earths utilizing small differences in migratory velocity of their ions. La was separated quantitatively from Nd and Sm; Pr from Nd and Sm; also, a strong shift in the concentration of Sm was obtained from a mixture of terbia earths. In the cathode chamber, the elements appeared as a series based on their ionic mobility which is greatest with lanthanum and decreases regularly with increasing atomic weights. The analyses were done with the aid of absorption spectra. (auth)

7765 NP-tr-63

REPORT ON THE STATE OF RESEARCH, ON NOVEMBER 14, 1956, ON A HYDROCYCLONE FOR THE SEPARATION OF UO_2 PARTICLES FROM AN AQUEOUS SUSPENSION. P. J. Kreyger and L. J. Declman. Translated by S. Fitzgerald from Report from Naamloze Vennootschap voor Kenring van Elektrotechnisch Materialen, Arnhem, Holland. (KEMA). 17p.

Measurements were made of the yield of a hydrocyclone designed by KEMA. In order to test the installation and become familiar with its behavior, tests were first made with sand particles whose diameters were such as to give a falling speed comparable to that of uranium oxide particles of diameters between 4 and 20 μ in water at 20°C. One measurement was made for a UO_2 suspension with particles between 0 and 20 μ. By this measurement the lower limit of separated particles was established. It is pointed out that only one measurement was made for a UO_2 suspension. This should be borne in mind when judging the conclusions with respect to the UO_2 suspension. Conclusions were drawn due to the extreme exactness of the measurement. (auth)

7766

ON THE IODIDE METHOD OF PURIFYING ZIRCONIUM. K. D. Sinelnikov, F. I. Busol, and G. I. Stepanova. Atomnaya Energiya 4, 169-74(1958). (In Russian)

The equilibrium constants k and k' in the reactions $Zr + 2I_2 - ZrI_4 = 0$ and $2I - I_2 = 0$ have been determined by a method based on the measurements of recovered iodide and zirconium from zirconium tetraiodide decomposition on the heated surface during the equilibration process. The decomposition of tetraiodide takes place on the tungsten filament at 900 to 1600°C. The temperature distribution between the filament and the container walls was not considered. The relation of the total of the atomic and molecular iodide pressure $P_I + P_{I_2}$ to the zirconium tetraiodide pressure at 1430°C and on the temperature with $P_{ZrI_4} \approx 50$ mm of mercury is given. (tr-auth)

7767

REACTOR FUEL PROCESSING. Technical Progress Review, Vol. 1, No. 1. Lemont, Argonne National Laboratory, 1958. 38p. Available from U. S. Government Printing Office for $0.55.

Commercial Aspects of Fuel Processing. An AEC price list is presented for plutonium produced in private reactors. The price paid for plutonium varies as a function of Pu^{240} content. The construction and operating costs are given for a hypothetical chemical processing plant running at full capacity for 300 days/year. Storage of fuel elements from various types of reactors is discussed. A flowsheet is given of the Darex Process for processing stainless steel fuels by dissolution in dilute aqua regia. Various other processes are discussed for processing fuels consisting of other alloys. Fuel-Processing Research and Development. In this section new work is reported on existing separations processes and on proposed processes, solvent extraction, plant and equipment design and operation, ion exchange, fluoride volatility processes, bromine trifluoride processes, fused-salt process, pyrometallurgical processing, EBR-II melt refining process, processing of U–Bi reactor fuels by

fused-salt extraction, blanket processing methods, corrosion, and homogeneous reactor processing. Waste Disposal. A flow diagram is given for a radioactive liquid and gaseous waste-disposal system for the Shippingport Pressurized Water Reactor. A flow diagram is given for radioactive solid waste disposal. A process is discussed for the evaporation and calcination of liquid wastes for disposal. Three methods are discussed for the isolation of Cs^{137} from liquid wastes. Conversion to Final Products Operations. The production of UO_2 and UO_3, oxidation of UF_4 to UF_6, and the preparation of Pu and U metal are discussed in this section. (W.L.H.)

Sorption Phenomena

7768

HEATS OF ADSORPTION OF OXYGEN ON SOLID SOLUTIONS OF URANIUM DIOXIDE IN THORIUM DIOXIDE AT −183°. J. D. M. McConnell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc. 947-50(1958) Mar.

By use of a "cyclone micronizer," specimens of solid solutions containing 20 mole % and 10 mole % of uranium dioxide in thorium dioxide have been prepared having surface areas of about 12 $m.^2/g$. The initial heat of adsorption of oxygen on these solid solutions at −183° falls as the uranium content is decreased. A slow evolution of heat at partial coverage has been observed, but differs from that noted earlier on pure uranium dioxide. (auth)

Spectroscopy

Refer also to abstract 7738.

7769 UCRL-5078

California. Univ., Livermore. Radiation Lab.
THE INFRARED SPECTRA OF HMX AND RDX. Ann Werbin. Dec. 31, 1957. 8p. Contract W-7405-eng-48. $0.50(OTS).

Infrared data are presented for the β crystalline form of HMX and the α modification of RDX as a function of temperature from −180 to +220°C. Some of the fundamental frequencies are assigned to specific vibrations. (auth)

Syntheses

Refer also to abstract 8227.

7770 NBS-5792

National Bureau of Standards, Washington, D. C.
CARBON-14 CARBOXY-LABELED POLYSACCHARIDES. J. D. Moyer and H. S. Isbell. Feb. 28, 1958. 10p. $0.50(OTS).

Procedures are given for the preparation of C^{14} carboxydextran and C^{14} carboxyinulin. These materials have C^{14}-labeled carboxyl groups in place of the reducing end groups present in the parent polysaccharides. The substances can be prepared cheaply and should find many applications as tracers in biological and chemical research. (auth)

7771 NP-6664

Burke Research Co., Van Dyke, Mich.
RESEARCH AND DEVELOPMENT OF HI-TEMPERATURE NUCLEAR RADIATION RESISTANT ELASTOMERS. Quarterly Progress Report No. 2 [for] October 1 to October 31, 1957; January 20 to March 15, 1958. Oscar Grace, Ralph E. Isley, Barbara Hunt, Pauls Davis, Urs F. Nager, and Eldon E. Stahly. Mar. 21, 1958. 41p. Contract AF33(616)-5303.

Elastomers were prepared, via various contact catalysts, which have fair to excellent gum and vulcanized tensile properties. Samples are to be evaluated for radiation stability in comparison with GR-S, natural rubber, and polyethylene. The polymers were designed to show the effect of unsaturation, methyl groups, and phenyl groups on the linear polymethylene chain. Samples prepared for irradiation are discussed. (For preceding period see NP-6464.) (W.L.H.)

7772 WADC-TR-58-84

Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF HIGH-TEMPERATURE STABLE LIQUID UREAS AND AMIDES. Cecil C. Chappelow, Jr. and Robert N. Clark. Jan. 1958. 71p. Project title: HYDRAULIC FLUIDS. Contract AF33(616)-5129.

A program for the development of thermally stable liquid ureas was undertaken. This program consisted of the synthesis and evaluation of new compounds which contain only carbonyl groups, nitrogen atoms and organic radicals. The first class of compounds to be investigated has been the tetra-substituted ureas. During the synthesis program a total of 26 tetra-substituted ureas were prepared, 23 of which are new compositions of matter not reported in the literature. These compounds are representative of the following types of tetra-substituted ureas: tetraalkylureas, dialkyldiarylureas, tetraalkarylureas, dialkaryldiarylureas, N-(substituted phenyl)triphenylureas and tetraarylureas. During the evaluation program, primary emphasis was placed upon thermal stability. As a result of this work, it was found that the basic urea structure was very stable. Also, it was found that the following substituent groups were thermally stable: diphenylene, phenyl, 4-methylphenyl, 4-biphenylyl, 4-methoxyphenyl, 2,4-dimethylphenyl, 1- and 2-naphthyl, n-octadecyl, methyl, 4-methoxyphenyl, n-hexadecyl, and n-butyl. On the basis of preliminary experimental data, tetra-substituted ureas as a class of compounds show promise as base materials for high-temperature hydraulic fluid and lubricant applications. (auth)

Transuranic Elements and Compounds

7773 UCRL-2532

California. Univ., Berkeley. Radiation Lab.
HEAVY ELEMENTS RESEARCH NOTES BASED ON A SERIES OF LECTURES DELIVERED AT THE NOBEL INSTITUTE FOR PHYSICS, STOCKHOLM, SPRING, 1953. J. O. Rasmussen. Mar. 31, 1954. 56p. Contract [W-7405-eng-48]. $9.30(ph OTS); $3.60(mf OTS).

Lectures are included on pile and accelerator production of transuranium nuclides, the systematics of alpha decay, and the chemistry of the heaviest elements. The chemistry lecture is given only in outline form with literature references. A table of $\gamma(\gamma)$ for alpha decay rate calculations is included in an appendix. (M.H.R.)

7774

EFFECT OF IRRADIATION ON THE VALENCE STATE OF PLUTONIUM IN NITRIC ACID SOLUTIONS. N. I. Popov, V. I. Medvedovskii, and N. A. Bakh. Atomnaya Energiya 4, 154-60(1958). (In Russian)

Investigations were made of the x-radiation effects on the valence of plutonium in nitric acid solutions of 0.3 to 2.0 M and in nitric acid solutions of 0.3 M containing various concentrations of $UO_2(NO_3)_2$ and $K_2Cr_2O_7$. In nitrate solutions not containing $UO_2(NO_3)_2$ the irradiation induces only the

oxidation of plutonium, whereupon the yield of oxidation diminishes with the increase of the ionic concentration of NO_3 and the acidity of the solution. Under certain conditions, plutonium can be recovered in the presence of $UO_2(NO_3)_2$. Obviously this is achieved not by the atomic hydrogen but by UO_2^+ ions. The presence of potassium bichromate accelerates the irradiation oxidation process of plutonium; however, in some cases it does not hinder the recovery of plutonium. (tr-auth)

7775

PREPARATION OF ELEMENT 102. V. I. Goldanskii. Priroda 46, No. 12, 79-80(1957) Dec. (In Russian)

A report is made about the discovery and preparation of nobelium. (R.V.J.)

Uranium and Uranium Compounds

Refer also to abstract 7680.

7776 KAPL-1672

Knolls Atomic Power Lab., Schenectady, N. Y.

REACTOR FUELS SUSPENDED IN LIQUID METALS. II. FUEL PREPARATION AND CAPSULE STUDIES OF LIQUID METAL–UO_2 SLURRIES. F. K. Heumann, O. N. Salmon, and E. A. Wilk. June 12, 1957. 45p. Contract W-31-109-Eng-52. $1.25(OTS).

A method of preparing finely divided UO_2 by the H_2 reduction of UO_3 and subsequent ball-milling resulted in a material with a median particle size of 6μ, which was used in liquid metal-UO_2 slurries. Three types of fuel in capsules were investigated. The UO_2-Na_2O system suspended in NaK was investigated and it was found that UO_2 will getter Na_2O in NaK to form a compound presumed to be Na_2UO_4. This fuel was sticky and was hence undesirable. The simple suspension of UO_2 in NaK was found to be fairly satisfactory but the UO_2 tended to form a thin film on the container walls. Any excess oxygen would convert this fuel into the $Na_2O \cdot UO_2$ type. The most promising fuel was the UO_2-U system suspended in NaK. It was found that the uranium reacted with the UO_2 to form a UO-type compound. Any oxygen entering such a system will be gettered by the UO which is then converted to UO_2. The fuel did not adhere to the container walls and had an average particle size of approximately 18μ. The corrosion of Type 316 stainless steel was less than 3 mils/yr for all three types of fuel. Loop behavior was simulated with regard to corrosion and particle size by rotating the capsules at 0.75 fps while they were heated. (auth)

7777

DETERMINATION OF THE OXIDATION STATE OF URANIUM IN APATITE AND PHOSPHORITE DEPOSITS. Roy S. Clarke, Jr. and Zalman S. Altschuler (U. S. Geological Survey, Washington). Geochim. et Cosmochim. Acta 13, 127-42(1958).

Geological and mineralogical evidence indicate that the uranium present in apatite may proxy for calcium in the mineral structure as U(IV). An experimental investigation was conducted and chemical evidence was obtained that establishes the presence of U(IV) in apatite. The following analytical procedure was developed for the determination of U(IV). Carbonate-fluorapatite is dissolved in 1.5 M orthophosphoric acid at a temperature of 5°C or slightly below and fluorapatite is dissolved in cold 1.2 M hydrochloric acid (approximately 5°C) containing 1.5 g of hydroxylamine hydrochloride per 100 ml. Uranium(IV) is precipitated by cupferron using titanium as a carrier. The uranium in the precipitate is separated by use of the ethyl acetate extraction procedure and determined fluorimetrically. The validity and the limitations of the method have been established by spike experiments. (auth)

7778

ORGANIC CO-PRECIPITANTS. COMMUNICATION 8. CO-PRECIPITATION OF URANIUM FOR ITS DETERMINATION IN SEA WATER. V. I. Kuznetsov and T. G. Akimova (Vernadsky Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 13, 79-82(1958) Jan.–Feb. (In Russian)

Even at a dilution of 1 in 10^{10} uranium can be quantitatively co-precipitated with methyl-violet thiocyanate, precipitating from acidified sea water on adding ammonium thiocyanate and methyl violet. The precipitate is filtered off and ignited. A residue contains the co-precipitated uranium. (tr-auth)

7779

POLAROGRAPHIC DETERMINATION OF URANIUM IN THE PRESENCE OF VANADIUM AND IRON. Yu. V. Morachevskii and A. A. Sakharov (Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 13, 83-7(1958) Jan.–Feb. (In Russian)

Two modifications of the method for the polarographic determination of uranium in the presence of vanadium and iron have been developed. The first is based on the measurement of the limiting current of sexavalent uranium at the constant concentration of vanadium in the solution. In the second modification an electrolysis of the solution with a mercury cathode is carried out, then uranium is determined on an anodo-cathodic wave U^{III}/U^{IV}. (tr-auth)

7780

GRAVIMETRIC DETERMINATION OF URANIUM WITH THE USE OF CUPFERRON FOR ITS SEPARATION. S. V. Elinson and V. A. Oleznyuk. Zhur. Anal. Khim. 13, 95-9 (1958) Jan.–Feb. (In Russian)

The method is based on the separation of admixtures with cupferron and precipitation of tetravalent uranium with the same reagent after reduction with sodium hyposulfite. The method has been tested on pure uranium, artificial mixtures with accompanying uranium admixtures, as well as on ores and headings with various concentrations of uranium. The method can be used for the precision analysis of ores and headings containing more than 5 % of uranium in plant laboratories. One determination takes 4 to 5 hrs. Four samples can be analyzed simultaneously. The mean quadratic error of determination is estimated to be ±0.3 % relative for samples containing 50 % and ±1.2 % for samples containing 5 to 10 % of uranium. (tr-auth)

Waste Disposal

7781 CF-57-12-143

Oak Ridge National Lab., Tenn.

RADIOACTIVE WASTE DISPOSAL AND DECONTAMINATION ANNUAL REPORT FOR 1957. E. J. Witkowski. Apr. 18, 1958. 11p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

The operation of facilities, which include the hot-chemical and the metal waste systems, the process waste system, and the radioactive gas disposal system, is described. Also included is a report on equipment decontamination and off-shift services performed for the research divisions. (W.L.H.)

7782 ORNL-2475

Oak Ridge National Lab., Tenn.

LABORATORY STUDIES ON THE GROUND DISPOSAL OF ORNL INTERMEDIATE-LEVEL LIQUID RADIOACTIVE WASTES. Richard L. Blanchard, Bernd Kahn, and Gordon G. Robeck. Apr. 11, 1958. 34p. Contract W-7405-eng-26. $1.00(OTS).

Radioactive waste and ground water solutions were passed through columns of indigenous Conasauga shale to

determine the sorptive behavior of the radionuclides. Cesium-137, the major radioactive constituent of the basic waste solution, was adsorbed very effectively with a shale/solution distribution ratio of 500. A small fraction of ruthenium-106, the only other radionuclide present in relatively large concentration, was adsorbed per unit weight of shale, but this adsorption occurred even when the radionuclide had previously passed through 200 feet of shale. The ruthenium and the small amounts of cobalt-60 and antimony-125 present were removed by coprecipitation with lead dioxide after the addition of sodium hypochlorite. By combining coprecipitation with adsorption on shale columns, it was possible to obtain decontamination factors of 2×10^3 for gross beta, 3×10^3 for gross gamma, 4×10^4 for cesium, and 2×10^2 for ruthenium. (auth)

ENGINEERING

7783 WADC-TR-56-331(Pt. II)
Firestone Tire and Rubber Co., Akron, Ohio.
DEVELOPMENT OF HIGH TEMPERATURE RESISTANT RUBBER COMPOUNDS. Period Covered: July 15, 1956 to November 30, 1957. Robert A. Hayes, Floyd M. Smith, Ward A. Smith, and Leland J. Kitchen. Jan. 24, 1958. 188p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: COMPOUNDING OF ELASTOMERS. Contract AF33(616)-3953. (AD-151003).

Elastomers of potential interest for high-temperature aircraft tires — including butyl, silicone rubber, "heat-stable" polyurethane, and Viton A — were studied to determine tensile, wire-cord adhesion, and air-permeability properties at temperatures ranging up to 400 or 500°F, and properties of interest in tire development, such as internal friction and running temperature. Most promising wire adhesions were obtained with silicone rubber, which retained 63% of the 75°F adhesive strength at 450°F, compared with 9% for Hevea. Silicone rubber is the most highly permeable to air; Thiokol ST, Vyram and butyl have the lowest air permeabilities. Nitrogen appears to be the most promising of the unreactive gases to use for inflation of high-temperature tires. Type of sulfur crosslink (mono-, di-, or tetrasulfide) had little effect on high-temperature properties of Hevea. Gamma-irradiation of vulcanized Hevea improved the high-temperature tensile strength. Balata had lower tensile strength than Hevea over the entire range of 73 to 400°F. Vyram N-7700 was about equivalent to Vyram N-5400. Polyether-type polyurethane had 400°F tensile strength of 60 psi vs. 515 for the "heat-stable" polyester type. Teflon resin had a tensile strength of 3825 psi at 73°F and 980 psi at 600°F.

Studies on effects of a 4-hour heat-aging at 400°F upon burst pressures of a nylon aircraft tire and of a wire tire are described. It is concluded that a 400°F tire will require wire tirecord in place of organic fabrics used in present tires. A prototype aircraft tire successfully was constructed from silicone rubber and steel wire tirecord. Coating the wire tirecord and the bead wire with a thin layer of partially cured silicone rubber facilitated fabrication of the beads and plies. Experimental butadiene and acrylic polymers containing functional groups were prepared and their high-temperature properties were determined. Carboxyl as the functional group gave better results than hydroxyl or epoxy. Best properties at 400°F resulted from using a metal oxide — particularly magnesium oxide or cadmium oxide — with epoxy resin to cure the carboxy polymers, enabling 400°F tensile strengths as high as 1400 psi to be obtained. The advantages of the metal oxide cure were obtained with methacrylate rubber (copolymer of butadiene and methyl methacrylate) by curing with barium hydroxide octahydrate, which gave tensile strengths of 4025 psi at 73°F and 960 psi at 400°F when used in combination with bis(α,α-dimethylbenzyl) peroxide. In this manner the advantageous high-temperature properties of the metal oxide cure were realized with improved processability compared with the carboxy polymers. It was found that butadiene copolymers can be vulcanized by heat alone at 500°F, a GR-S–carbon black mix giving a tensile of 2450 psi; but this crosslinking could only partially be inhibited. Salicylate esters were the most effective inhibitors. (auth)

7784 Y-1172
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
AN APPLICATION OF SOME INDUSTRIAL ENGINEERING PRINCIPLES TO AN ELECTRICAL MAINTENANCE ORGANIZATION. George W. Oliphant. Aug. 1, 1957. 149p. Contract W-7405-eng-26. $4.00(OTS).

Some Industrial Engineering and Management principles are defined and discussed briefly. Examples of the application of these principles are presented to demonstrate their use in a maintenance organization. The study is intended to be illustrative rather than conclusive. (auth)

7785 AEC-tr-2822(Pts. I and II)
[PART] I. THE NONUNIFORMITY OF DEFORMATION ON PLASTIC COMPRESSION. [PART] II. THE DISTRIBUTION OF DEFORMATION ON COMPRESSION OF CYLINDERS AT HIGH RATES. G. I. Karpov. Pt. I translated from Fizika Metallov. i Metallovedenie 2, 168-71(1956). 6p. Pt. II, Ibid., 172-5. 6p.

The deformation of a cylindrical sample fastened to a rigid base by a freely flying block is rather nonuniform. The part adjacent to the one receiving the blow is deformed less than the part adjacent to the anvil. The difference between the degrees of deformation can be explained only by the action of forces of inertia. The distribution of the rates of deformation along the heights of the samples is also nonuniform. The part adjacent to the block is deformed in the first half of the process at a larger rate than the part adjacent to the anvil. (W.L.H.)

7786 AEC-tr-2862
DEVELOPMENT POSSIBILITIES OF GAS TURBINE PROCESS. (Entwicklungsmoeglichkeiten der Gasturbinenprozesse). H. Flatin. Translated from Dresden. Tech. Hochochule Wiss. Z. 2, 719-34(1952-1953). 50p.

The advantages and disadvantages of the combustion turbine process over the gas turbine process are discussed. A gas turbine that uses as a propellant air circulating in a closed cycle is called the gas turbine process. A turbine that operates on an open cycle and is driven by the combustion gases is called the combustion turbine process. (W.L.H.)

Aerosols

7787 ALI-14
Little (Arthur D.) Inc., Cambridge, Mass.
INVESTIGATION OF THE STACK GAS FILTERING REQUIREMENTS AND DEVELOPMENT OF SUITABLE FILTERS. Report No. 5. May 31, 1949. 19p. $0.10 (OTS).

Investigation of dust loading capacity for various assemblies of air filter media on atmospheric dust has continued using the small tester described in previous reports. The effect of fiber size and packing density in Fiberglas mat has been studied. The combination of very fine fibered glass mats now in use at Oak Ridge was given

special investigation. Tests were made using a coarser mat as a prefilter and an economic advantage was shown for such protection. As a result of laboratory studies on gauze backed hand sheets, a paper mill run is planned to make paper comparable to #6 now used by Chemical Corps for AEC filters, but stronger and lower in cost. In this run the paper will be made with a reenforcing gauze backing. Fabrication work is being carried on with emphasis on two special shapes of units both of which aim to simplify installation and removal and to give better protection to operating personnel when filters are being changed. These shapes, namely the hollow cube and the circular, will be described in detail with sketches and test data. A 950 CFM full scale model of the hollow cube has been constructed to demonstrate the practicability of the design. Performance tests have been made and are reported. (auth)

7788 NYO-4613

Harvard Univ., Boston. Air Cleaning Lab.
PERFORMANCE OF THE HOFFMAN CYCLONE. Richard Dennis, Edward Kristal, and Leslie Silverman. Mar. 31, 1958. 43p. Contract AT(30-1)-841. $6.30(ph OTS); $3.00(mf OTS).

Performance tests were conducted on a cyclone collector developed and manufactured by the U.S. Hoffman Company to determine whether it had any special advantages for precleaning feed materials gas streams prior to bag filtration. Weight collection efficiency and resistance were determined at flow rates ranging from 50 to 185 cu. ft per min. for atmospheric dust, copper sulfate microspheres, talc, and resuspended fly ash. Dust concentrations varied from 0.05 grain per 1000 cu. ft (atmospheric dust) to 31 grains per cu. ft (fly ash). Fly ash collection was investigated as a function of gas temperature, 70 to 700°F, and inlet loading, 0.1 to 31 grains per cu. ft. Test results indicated that special design features of this unit did not materially increase the collection efficiency above that of simple cyclones. Furthermore, the resistance at rated flow was considerably higher than that for other collectors furnishing the same efficiency. (auth)

Heat Transfer and Fluid Flow

7789 WAPD-TH-404

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
ESTIMATED FILM BOILING HEAT TRANSFER COEFFICIENTS. O. J. Mendler. Mar. 26, 1958. 16p. $3.30 (ph OTS); $2.40(mf OTS).

A method is presented for estimating conservative values of film boiling heat transfer coefficients as a sum of a convection coefficient and a radiation coefficient. The convection coefficient is calculated by assuming pure conduction through a maximum sustainable laminar vapor layer. The radiation coefficient is estimated using the expression for thermal radiation between two parallel walls. (D.E.B.)

7790

A NEW METHOD OF HEAT-EXCHANGER DESIGN WITH SPECIFIED INLET AND OUTLET CONDITIONS. R. S. Fairall (Garrett Corp., Los Angeles). Trans. Am. Soc. Mech. Engrs. 80, 601-11(1958) Apr.

In order to solve the general design problem for a heat exchanger, the relative advantages of a number of possible solutions must be compared with the respective disadvantages. The solutions may be compared on a basis of flows, pressure losses, temperatures, and heat-exchanger size and weight. This paper develops a set of simultaneous equations which expresses the size of a heat exchanger as a function of the operating conditions and the surface temperatures within the unit and permits this comparison to be made on an analytical basis. The general case of counterflow, parallel flow, single-pass crossflow, and two-pass crossflow are solved; examples and figures are included. (auth)

7791

HEAT-TRANSFER RATES TO CROSS-FLOWING MERCURY IN A STAGGERED TUBE BANK. II. C. L. Rickard (General Dynamics Corp., San Diego, Calif.), O. E. Dwyer (Brookhaven National Lab., Upton N. Y.), and D. Dropkin (Cornell Univ., Ithaca, N. Y.). Trans. Am. Soc. Mech. Engrs. 80, 646-52(1958) Apr.

As part of a continuing liquid-metal heat-transfer program at the Brookhaven National Laboratory, both local and tube-average heat-transfer coefficients have been obtained for the flow of mercury normal to a staggered tube bank. The bank consisted of sixty ½-in. tubes, six wide and ten deep, arranged in an equilateral-triangular array. The paper presents results showing the effects of flow rate, Prandtl number, wetting, gas entrainment, and tube location on the tube-average coefficients. The angular variation of the local coefficient is not considered here, owing to the fact that the values have not been calculated completely from the original data. The mercury results are compared with a few results obtained with water in the same equipment. The heat-transfer runs cover the Reynolds number range of 20,000 to 200,000, whereas the water runs cover the range 8000 to 20,000. Pressure-drop results for both water and mercury flow through the tube bank are reported also. The mercury coefficients for tubes in the interior of the tube bank are well represented by the equation $Nu = 4.03 + 0.228(Pe)^{0.67}$. (auth)

7792

HEAT TRANSFER IN LIQUID METALS. P. S. Lykoudis and Y. S. Touloukian (Purdue Univ., Lafayette, Ind.). Trans. Am. Soc. Mech. Engrs. 80, 653-66(1958) Apr.

The problem of heat transfer in liquid metals is studied for the case of a fully developed turbulent flow in cylindrical pipes of constant diameter, the fluid under consideration being heated (or cooled) by a constant and uniform heat input at the wall. In the analysis, the similarity theory between heat and momentum transfer is used. A theory is presented which gives the ratio of eddy diffusivities for heat and momentum transfer as a function of the Prandtl modulus. It is shown that heat transfer in liquid metals can be analyzed universally in terms of a dimensionless parameter called the "generalized Peclet modulus" and defined by by the relation $N_{Pe}^* = (N_{Re}^*)(N_{Pr}^*) = [N_{Re}(f/2)^{1/2}](N_{Pr}\sigma)$. Temperature profiles are presented and the limiting cases for $N_{Pr} = 0$ are studied. (auth)

7793

ON THE STABILITY OF BOILING HEAT TRANSFER. Novak Zuber (Univ. of California, Los Angeles). Trans. Am. Soc. Mech. Engrs. 80, 711-20(1958) Apr.

Boiling heat transfer in the nucleate region is reviewed. The transition film-boiling region is analyzed by considering the stability of a plane vortex sheet separating two inviscid fluids. Using the classical results of Helmholtz, Kelvin, and Rayleigh, expressions have been derived that predict the maximum and minimum heat-transfer rates in the nucleate and the film-boiling regimes, respectively. The model exhibits the essential features of the phenomenon and shows good agreement with experimental data. (auth)

7794

GAS-FRICTION–HEAT TRANSFER CHARTS FOR DUCTED FLOWS. S. V. Manson (Curtiss-Wright Research Div.,

Nuclear Power Dept., Clifton, N. J.). Trans. Am. Soc. Mech. Engrs. 80, 733-8(1958) Apr.

Charts that speed heat-exchanger calculations and aid analysis of other ducted gas flows are illustrated and examples of their use are presented. (auth)

7795

HEAT TRANSFER TO SUPERCRITICAL WATER. N. L. Dickinson (Babcock & Wilcox Co., New York) and C. P. Welch (Babcock & Wilcox Research Center, Alliance, Ohio). Trans. Am. Soc. Mech. Engrs. 80, 746-52(1958) Apr.

Heat-transfer coefficients for supercritical water are presented for flow in an electrically heated AISI Type 304 stainless-steel tube having an inside diameter of 0.300 in. Bulk fluid temperatures were varied from 220 to 1000°F at 4500 psi, and over a more limited temperature range at 3500 psi. Mass flows tested include 1.6 to 2.5 × 10^6 lb/hr-sq ft, and a flux range of 280,000 to 580,000 Btu/hr-sq ft was covered. Values of film conductance in the vapor region were found to be substantially higher than those predicted by extrapolation of data found in the literature, or by recent formulas based on a theoretical approach. These findings are of special interest to the boiler industry which is presently designing units for use at supercritical conditions. (auth)

Materials Testing

Refer also to abstract 7852.

7796 CRRD-750

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

AN EDDY CURRENT DEVICE FOR MEASURING ALUMINUM CLADDING ON URANIUM FUEL ELEMENTS. A. R. Jones. Feb. 1958. 15p. (AECL-560). $0.50(AECL).

Uranium Fuel Elements for the N.R.U. reactor are clad in aluminum by an extrusion cladding process. It has been found convenient to clad the uranium with an aluminum sheath around 0.100 in. in thickness and afterwards to machine the aluminum to the required thickness. The total thickness of uranium and aluminum cladding is fixed by the size of the die through which it is extruded. Also, since the uranium thickness is set by specification, the total thickness of the two aluminum sides is fixed provided that uranium is undeformed. However, it is conceivable that the uranium could be fed through the die eccentrically resulting in a difference in thickness between the two aluminum sides. Since subsequent machining is performed relative to the aluminum outer surface this defect will appear in the final fuel element. If the defect is excessive it is desirable to detect it before machining. It was decided to attempt to make an eddy current device for this purpose since it could be made simply, reliably, and cheaply. The difficulty lay in the thickness of aluminum which had to be measured. However, the fact that aluminum and uranium have widely differing electrical conductivities and that the total thickness of aluminum was constant, made the eddy current approach attractive. When a conductor is placed near a coil then the impedance of the coil is modified both in phase and magnitude. This modification is a function of the conductivity and spatial distribution of the conductor with respect to the coil. In the case of aluminum clad uranium, if a coil is placed near the cladding then the cladding thickness will affect the impedance of the coil which provides a means of sensing changes in thickness. (auth)

7797 DTMB-911 (Rpt: UNCLASSIFIED)

David W. Taylor Model Basin, Carderock, Md.

OBSERVATIONS OF STRESSES AND STRAINS NEAR INTERSECTIONS OF CONICAL AND CYLINDRICAL SHELLS. Matthew F. Borg. Mar. 1956. 71p.

To test theory, models of the interaction of a conical and cylindrical shell, having three different apex angles in the cone and three different ratios of thickness to cylinder diameter, were subjected to internal hydrostatic pressure, and the resulting strains at various points were measured. Careful studies were made of the unavoidable imperfections in the models. The results are in substantial agreement with the Wenk-Taylor approximate theory described in TMB Report 826, and with the approximate theory of Geckeler. Comparisons are also made with other theories. (auth)

7798 NP-6634

Forest Products Lab., Madison, Wis.

THE RHEOLOGICAL PROPERTIES AND STRENGTHS EXHIBITED BY ADHESIVE MATERIALS WHEN PRESENT AS BONDS. Final Report. Harold Tarkow, Charles B. Norris, J. T. Drow, and William L. James. [1957]. 131p. DA Project 599-01-004.

The rheological and breaking characteristics of thin adhesive films present as bonds are examined. Details of construction and use of an extensometer developed for these tests are presented with stress and strain curves and tables for film bonds of polystyrene, polyvinyl formal type adhesive, and buna N rubber. The apparatus used to determine the fracture under impact of viscous silicones and polyisobutylene is described, along with experimental results of tests. (J.R.D.)

7799

DIMENSIONAL MEASUREMENTS USING NONDESTRUCTIVE TECHNIQUES. Bernard Cunningham (Westinghouse Electric Corp., Cheswick, Penna.). J. Soc. Non-Destructive Testing 16, 161-4(1958) Mar.-Apr.

Several experiments designed to determine the errors inherent in radiographic measurement of the thickness of fuel element cladding are summarized. Errors involved in ultrasonic thickness measurement are also described. (J.E.D.)

Pumps

7800 WAPD-CTA-EL-2685

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]

ALLIS CHALMERS 4000 GPM MAIN COOLANT PUMP INSPECTION REPORT. W. B. Garvey. [1957?]. 3p. $1.80(ph OTS); $1.80(mf OTS).

Waste Disposal

7801 AECU-3618

Michigan. Univ., Ann Arbor. Engineering Research Inst.

PREPARATION OF RADIATION SOURCES FROM FISSION PRODUCTS BY THE CLAY PROCESS. J. E. Schoolmeester and J. J. Martin. Aug. 1957. 16p. Contract AT(11-1)-162. (ERI-1943-4-106-P). $0.75(OTS).

This study was made to determine the feasibility of producing usable radiation sources by the montmorillonite clay process. The clay process was developed at Brookhaven National Laboratory primarily to solve the problem of ultimately disposing of waste fission products. After reviewing the process in detail, it is shown that radiation sources may be prepared with specific activity as high as 4.5 curies of Ce^{137} per gram of clay. Sources of this strength would be entirely suitable for such processing applications as promotion of chemical reactions, preservation of foods, or sterilization of drugs. Furthermore, the operations involved in the clay process are simpler and

more straightforward than those of any other process for making radiation sources from fission products. It is concluded from this study that some clay sources should be prepared to demonstrate the actual process. (auth)

7802 NP-6653

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE INDUSTRIAL UTILISATION OF FISSION PRODUCTS. R. Roberts. [1955?]. 22p.

Industrial applications of fission products are reviewed. In addition to the economic aspects of salvaging uranium fission products the increasing problem of storage will be partially solved. It is estimated that by 1975, 18.5 tons of U^{235} will be used in power plants of Great Britian alone each year. This would mean an almost equal mass of depleted uranium which could be utilized in a recovery program. It is believed that sufficient experience has now been accumulated within the Atomic Energy Authority for workers to feel that no difficulty will be encountered in handling very large sources on an industrial scale. It is anticipated that the demand for these sources will increase and that there will be many possibilities for their use in industry. Part two of this article deals with some of these possibilities. (A.C.)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

Refer also to abstract 8230.

7803 AGARD-99

North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.

CERMETS AS POTENTIAL MATERIALS FOR HIGH-TEMPERATURE SERVICE. O. A. Sandven. Apr. 1957. 29p.

Presented at the Fifth Meeting of the Structures and Materials Panel, Apr. 24 to 27, 1957, in Oslo, Norway.

A review is given of the chemical, physical and mechanical properties of the most important and promising transition metals and cermet systems, with special attention to the creep resistance and ductility. (NATO abst)

7804 AEC-tr-2895

A PROCESS OF PRODUCING A DIELECTRICUM BASICALLY CONTAINING MAGNESIUM TITANATE AND A CONDENSOR MANUFACTURED FROM THE ABOVE MENTIONED SUBSTANCE. (Description of the Patent). Translated from a Hungarian Patent (Budapest, Apr. 1948). 4p.

A method is described for producing condensers with small dielectric loss coefficients but which have a low dielectric constant. According to the invention, this will be achieved by adding lead borate to materials containing basically magnesium titanate; or during the firing, red lead and water-insoluble borate, such as calcium borate, to those substances basically containing magnesium titanate. (W.L.H.)

7805

DEVELOPMENT OF CERAMIC INSULATING MATERIALS FOR HIGH-TEMPERATURE USE. W. D. Kingery and J. D. Klein (Massachusetts Inst. of Tech., Cambridge), and M. C. McQuarrie (Pennsylvania State Univ., University Park). Trans. Am. Soc. Mech. Engrs. 80, 705-10(1958) Apr.

Factors affecting the thermal conductivity of ceramics in the temperature range from 2200 to 4000°F are considered from the point of view of high-temperature insulation. The effective conductivity of solids and pores over a wide range of temperatures is analyzed. Particular attention is devoted to the effects of structure and phase distribution. This analysis is related to the development of optimum properties in thermal insulation for the temperature range considered. (auth)

Corrosion

Refer also to abstract 8082.

7806 BW-3792

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

THE CORROSION TESTING OF VARIOUS MATERIALS IN SODIUM. W. Markert, Jr. Aug. 4, 1954. 31p. $4.80 (ph OTS); $2.70(mf OTS).

These tests were conducted to determine the corrosion resistance of various structural materials to liquid sodium at a temperature of 1100°F and to determine if the materials are satisfactory for use in a reactor power plant. Three separate tests were conducted using a modified enclosed rotor pump corrosion apparatus with sodium at 1100°F and with the specimens at an absolute velocity of 55 ft/sec and static. The materials investigated were a group of 300 series stainless steels, Croloys, nickel alloys, Zircaloy 2, carbon steel, Globeiron, and modified Globeiron. The Globeiron materials were essentially extra low carbon iron to which various alloy materials had been added in two cases. (auth)

7807 BW-3988

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

INVESTIGATION OF THE CORROSION AND MASS TRANSPORT RESISTANCE OF STRUCTURAL MATERIALS TO LIQUID SODIUM. PART I. R. F. Dudek. PART II. K. Mildred Ferguson. Apr. 23, 1957. 41p. $7.80(ph OTS); $3.30(mf OTS).

These tests were conducted to determine the corrosion and mass transport resistance of various structural materials to liquid sodium in a dynamic test loop operating at a temperature differential. (auth)

7808 BW-7020

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

THE CORROSION TESTING OF VARIOUS MATERIALS IN SODIUM. PART I. R. F. Dudek. PART II. K. Mildred Ferguson. Apr. 26, 1957. 39p. $6.30(ph OTS); $3.00 (mf OTS).

These tests were conducted to determine the corrosion resistance of various materials to liquid sodium at a temperature of 1100°F. Four separate tests were conducted using a modified enclosed-rotor pump corrosion apparatus with sodium at 1100°F and with the specimens at an absolute velocity of 55 ft/sec and static. The materials tested were a group of 300 and 400 series stainless alloys, low Croloys, carbon steel, nickel alloys, zirconium, and Lukens-clad stainless steels. Oxygen was controlled by the use of a diffusion-type cold trap for three of the four tests. A flow-through cold trap was used for the fourth test. The measurement of the oxygen content was made both chemically and by the use of a plugging indicator. After test, the specimens were subjected to metallographic investigation. (auth)

7809 BW-7050

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

METALLURGICAL INVESTIGATION OF FUEL ELEMENT PINS TESTED IN LIQUID SODIUM. K. Mildred Ferguson. [1957?]. 33p. $6.30(ph OTS); $3.00(mf OTS).

Of the pins tested for corrosion resistance in sodium, the most promising ones were those with a swaged end cap. Although the pins swaged to a point appeared good visually, they contained deep folds vulnerable to marked attack. Pins capped by two methods obviously are unsatisfactory; the screw-cap mechanism and the countersunk cap locked by pressure both permit free circulation of sodium to the core alloy. The countersunk and welded method would be improved by a closer fit between cap and pin. Corrosion resistance of the pins capped by the resistance-welded method is determined by the pressure or absence of mechanical defects produced by welding. All zirconium surfaces in contact with freely circulating sodium developed the hard and brittle surface layer attributed to the absorption of oxygen into solid solution. All exposed core alloys oxidized during test. It has been proven that the formation of the hard and brittle surface layer on zirconium exposed to sodium is not related to the frequently observed mechanically deformed surface layer. Its formation is independent of prior surface condition. (auth)

7810 HDC-2214

[Hanford Works, Richland, Wash.]

CORROSION OF STAINLESS STEEL IN CONCENTRATED UNH SOLUTIONS: TRIP REPORT. Project C-362. J. M. Frame and J. M. Fox, Jr. May 17, 1951. Decl. May 10, 1957. 3p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

It is concluded that austenitic stainless steels in the fully solution-heat-treated state will give satisfactory service in concentrated UNH solutions. (M.H.R.)

7811 TT-725

NATURE OF THE CORROSION RESISTANCE OF STAINLESS STEELS. (Priroda Korrozionnoi Stoikosti Nerzhaveishchikh Stalei). G. V. Akimov. Translated by G. Belkov from Trudy Komissii Bor'be s Korroziei Metal. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, No. 2, 11-21(1956). 22p.

Geology and Mineralogy

7812

ISOTOPIC COMPOSITION OF PRIMEVAL LEAD OF THE EARTH. Akimasa Masuda (Nagoya Univ., Japan). Geochim. et Cosmochim. Acta 13, 143-52(1958).

Based upon the variation of isotopic composition of lead ores from the same site, the age of the earth is estimated to be 4.55 billion yrs (b.y. = 10^9 years). By assuming a fixed heterogeneity of two radioactive elements, thorium and uranium, we can obtain a self-consistent primeval lead with $Pb^{204} : Pb^{206} : Pb^{207} : Pb^{208} = 1 : 9.05 : 9.81 : 29.45$. These figures demonstrate for the first time that the isotopic composition of earth's primeval lead does not differ essentially from that of primeval lead of meteorites or troilite lead. It is the chief advantage of this approach that no knowledge of deposition time for the vast majority of samples is required. Although common igneous rocks are accountable for lead ores, mafic rock is of greater importance than felsic. (auth)

7813

THE RADIOACTIVITY OF ROCKS. René Coppens. Paris, Presses Universitaires de France, 1957. 126p.

Data from radiogeology, the study of the radioactivity of the earth in all its applications and consequences with the aim of discovering the effect of this radioactivity on geologic phenomena, are presented in this book. The constitution of matter and radioactivity are briefly discussed in two chapters. Then the radioactivity of igneous and sedimentary rocks is described. The methods of measuring geologic time by radioactivity are discussed. The thermal balance of the world is related to its radioactivity. (J.S.R.)

7814

COPPER AND URANIUM DEPOSITS OF THE COYOTE DISTRICT, MORA COUNTY NEW MEXICO. C. M. Tschanz, D. C. Laub, and G. W. Fuller. U. S. Geol. Survey Bull. 1030-L. 1958. 60p. and 9 illus.

The copper and uranium–vanadium deposits of the Coyote district, Mora County, N. Mex., are confined to the lower 2,000 ft of the Sangre de Cristo formation of Pennsylvanian and Permian (?) age. A narrow belt of deposits in steeply dipping or overturned rocks extends for 7 miles along Coyote Creek south of Guadalupita. Earlier studies showed that the copper deposits contained uranium, but the reserves and the uranium content of the copper-bearing shale are too small to justify any attempt to recover uranium. Several small, commercial-grade uranium deposits have been discovered in sandstone, however. Small isolated lenses of copper-bearing carbonaceous shale, siltstone, limestone or sandstone, interbedded with predominantly red rocks, are present at 12 or more stratigraphic levels. The better deposits, in carbonaceous shale, average about 2% copper. The copper content of the other rocks is usually lower, but small concentrations may contain 6% copper. The uranium deposits occur as small, closely spaced pockets that are commonly localized by sedimentary structures within one or more fluviatile arkosic sandstone beds near the middle of the formation, particularly where carbonized wood and clay and rock fragments are abundant. The uraniferous sandstone is commonly stained pink by hematite that was probably introduced with the uranium. The color increases in intensity with the radioactivity. The outcrops of the uranium deposits are typically inconspicuous, but close inspection reveals malachite, chalcopyrite, black vanadium minerals of micaceous habit, metatyuyamunite, and microscopic grains of an unidentified black uraniferous substance. The proportion of copper, uranium, and vanadium is variable and any of these metals may be dominant in the ore. The metals probably were derived from Precambrian granitic rocks. Copper and minor amounts of uranium were deposited in local stagnant basins by reaction with hydrogen sulfide and decaying organic material. The uraniferous shale and the copper deposits are probably syngenetic, or nearly so, but the uranium deposits in sandstone are epigenetic and probably were deposited from ground waters with a possible hydrothermal admixture. The uranium and vanadium may have been reconcentrated from earlier, low-grade, syngenetic deposits. The average copper ore body assays about 1.5% copper and contains less than 1,000 tons. The small size of known, commercial-grade uranium pockets and the small total uranium reserves will permit small-scale mining only under favorable conditions. Further exploration probably would result in an increase of uranium reserves, but no large deposits are expected. (auth)

7815

PRELIMINARY GEOLOGIC MAP OF THE NORTHWEST PART OF THE BURDOCK QUADRANGLE, FALL RIVER AND CUSTER COUNTIES, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 73. R. W. Schnabel and L. J. Charlesworth, Jr. Washington, U. S. Geological Survey, 1958. $0.50.

7816

PRELIMINARY GEOLOGIC MAP OF THE EAST CENTRAL PART OF THE BURDOCK QUADRANGLE, FALL RIVER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 74. R. W. Schnabel. Washington, U. S. Geological Survey, 1958. $0.50.

7817
PRELIMINARY GEOLOGIC MAP OF THE NORTHEAST PART OF THE DEWEY QUADRANGLE, CUSTER COUNTY, SOUTH DAKOTA, AND WESTON COUNTY, WYOMING. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 77. D. A. Brobst. Washington, U. S. Geological Survey, 1958. $0.50.

7818
PRELIMINARY GEOLOGIC MAP OF THE EAST CENTRAL PART OF THE DEWEY QUADRANGLE, CUSTER COUNTY, SOUTH DAKOTA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 78. D. A. Brobst. Washington, U. S. Geological Survey, 1958. $0.50.

7819
PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 1 NE QUADRANGLE, SAN JUAN COUNTY, UTAH, AND MONTROSE COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 139. William D. Carter, James L. Gualtieri, and Eugene M. Shoemaker. Washington, U. S. Geological Survey, 1958. $0.50.

7820
PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 2 SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 142. Gordon W. Weir and Vance C. Kennedy. Washington, U. S. Geological Survey, 1958. $0.50.

7821
PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 3 NW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 144. Gordon W. Weir and Chester L. Dodson. Washington, U. S. Geological Survey, 1958. $0.50.

7822
PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 3 SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 146. Gordon W. Weir and Chester L. Dodson. Washington, U. S. Geological Survey, 1958. $0.50

7823
PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 3 SE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 147. Gordon W. Weir and Chester L. Dodson. Washington, U. S. Geological Survey, 1958. $0.50.

7824
PRELIMINARY GEOLOGIC MAP OF THE MOUNT PEALE 4 SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 148. Gordon W. Weir and Chester L. Dodson. Washington, U. S. Geological Survey, 1958. $0.50.

7825
PRELIMINARY GEOLOGIC MAP OF THE CIRCLE CLIFFS 1 SE QUADRANGLE, GARFIELD COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 156. Edward S. Davidson, David A. Brew, and Louis D. Carswell. Washington, U. S. Geological Survey, 1958. $0.50.

7826
PRELIMINARY GEOLOGIC MAP OF THE CIRCLE CLIFFS 4 NE QUADRANGLE, GARFIELD COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 158. Edward S. Davidson, David A. Brew, and Louis D. Carswell. Washington, U. S. Geological Survey, 1958. $0.50.

7827
PRELIMINARY GEOLOGIC MAP OF THE VERDURE 2 NW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 162. Irving J. Witkind. Washington, U. S. Geological Survey, 1958. $0.50

7828
PHOTOGEOLOGIC MAP OF THE PARIA SE QUADRANGLE, KANE COUNTY, UTAH, AND COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-265. Kathleen McQueen. Washington, U. S. Geological Survey, 1958. $0.50.

7829
PHOTOGEOLOGIC MAP OF THE PARIA NE QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-266. Kathleen McQueen. Washington, U. S. Geological Survey, 1958. $0.50.

7830
AGE DETERMINATION OF ROCKS BY THE RUBIDIUM–STRONTIUM METHOD. H. Ewald, G. Felkel, E. Hebeda, and H. Kocher (Physikalisches Inst. der Technischen Hochschule, Munich). Z. Naturforsch. 13a, 235(1958) Mar. (In German).

Age determination measurements by the rubidium–strontium method have given widely varying results. In an attempt to improve the reproducibility of this method an optical spectrographic determination of the strontium–rubidium ratio was made on feldspar. The ratio obtained was $Sr/Rb = (10.9 \pm 0.2) \times 10^{-3}$. The ratio of the radioactive Sr^{87} to the total strontium content of the feldspar was determined to be $Sr^{87}/Sr = 0.745 \pm 0.006$. Using a half life of 5.0×10^{6} years for Rb^{87}, the age of the feldspar was calculated as $(2.08 \pm 0.04) \times 10^{9}$ years, a result in good agreement with the value 2.06×10^{9} obtained by the potassium–argon method. (J.S.R.)

Metals and Metallurgy

Refer also to abstracts 7728 and 8232.

7831 AECD-4257
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
WELDING PROCEDURE SPECIFICATION FOR WELDING OF AUSTENITIC STAINLESS STEEL TO CARBON STEEL BY SHIELDED METAL-ARC PROCESS. P. N. Seran. Dec. 11, 1954. Changed from OFFICIAL USE ONLY Jan. 2, 1958. 15p. $3.30(ph OTS); $2.40(mf OTS). (PS-AP-292269).

7832 AGARD-104
North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.
SELECTED PROPERTIES OF STRUCTURAL MATERIALS AT ELEVATED TEMPERATURES. D. A. Shinn. Apr. 1957. 46p.

Presented at the Fifth Meeting of the Structures and Materials Panel, Apr. 24 to 27, 1957, in Oslo, Norway.

This paper, which was prepared to supply additional information on design criteria for titanium alloys and other competitive materials, presents a review of some of the information which must be available to permit detail design of elevated-temperature aircraft and missile structures. Some of the design criteria information recently obtained in the U.S.A. are presented, the following aspects being discussed: static properties (compression, bearing, shear); long time compression, bearing and shear tests; short time (rapid loading) tensile and other tests; variable temperature and loading; creep and rupture affected by state of stress; column creep; miscellaneous elevated temperature effects; and low temperature. Some of the

results can be used for comparing metals, some can be used individually for design and in some cases both purposes can be served. (auth)

7833 BMI-1035(Del.)
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS REPORT FOR AUGUST 1955. Russell W. Dayton and Clyde R. Tipton, Jr. Sept. 1, 1955. Decl. with deletions June 18, 1957. 114p. Contract W-7405-eng-92. $18.30(ph OTS); $6.00(mf OTS).

Progress is reported on the following investigations: fuel-element end closures; effects of milling time on preparation of active UO_2 from UO_3; ignition reaction pressures of H_2-O_2 mixtures; corrosion loop studies with F^- and NaOH; corrosion of Mo in liquid NaK; cladding of Nb with Inconel; tensile and creep properties of Zr and Zircaloy; corrosion resistance of stainless alloys; hydration of UO_3; electrical and magnetic properties of UO_2; development of refractory fuel elements from BeO, $MoSi_2$, or graphite; casting, rolling, and forging of Al–Cr–Fe alloys; hardness testing of Nb alloys; powder-metallurgy studies of Nb; fabrication of UO_2-containing BeO tubes; preparation and properties of low-melting U alloys; mechanism of U corrosion; corrosion of Zr and U–Zr and Sn–Zr alloys; mechanical properties of heat-treated Zr alloys; development of porcelain-enamel coatings for Zr; heat treatment of U–Zr alloys; and hydridization of Zr and Zr alloys. (C.W.H.)

7834 BMI-1128(Del.)
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING AUGUST 1956. Russell W. Dayton and Clyde R. Tipton, Jr. Sept. 4, 1956. Decl. with deletions Mar. 6, 1958. 74p. Contract W-7405-eng-92. $12.30(ph OTS); $4.50(mf OTS).

Progress is reported in: development of materials; fuel element development; PWR development; metallurgy; Zr alloys; and studies for MCW. (T.R.H.)

7835 BMI-1238
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING NOVEMBER 1957. Russell W. Dayton and Clyde R. Tipton, Jr. Dec. 1, 1957. Decl. Feb. 4, 1958. 70p. Contract W-7405-eng-92. $2.00(OTS).

Data are given on the creep properties of annealed and 15% cold-worked Zircaloy-2 at elevated temperatures. The bond strength of several specimens was determined by welding Zr studs to the cladding and pulling them in a tensile machine until the cladding and the core were separated. The effect of metallic impurities on the electrical properties of UO_2 is being investigated. A program was initiated with the objectives of obtaining basic fatigue information on Inconel and also to establish a quantitative relationship between the variables of temperature, stress, strain, time, and cyclic frequency for Inconel subjected to repeated stressing. The reaction products of aqueous corrosion of U are being investigated to aid in understanding the corrosion mechanism. Data are given on the oxidation of Nb and Nb alloys in dry air. Studies of the solid-state bonding of metals have been continued with emphasis on the formulation of an expression relating adhesion, physical properties, and experimental conditions. Data are given on the reactions of UC_2 and UBe_{13} with various gases. Linear rate constants for the reaction of hydrogen with Nb are given. An investigation of the creep of tantalum at elevated temperatures is being conducted in an inert gas atmosphere. (For preceding period see BMI-1232.) (W.L.H.)

7836 BNL-472
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] JANUARY 3–APRIL 30, 1957. F. Maslan, ed. 69p. $2.00(OTS).

As a part of LMFR fuel processing studies, salt-metal distribution coefficients were measured for Sm, Nd, U, and Zr in the presence of various Mg concentrations. A polarographic method was developed for analyzing dilute molten salt solutions. Molten salt corrosion loop status is reviewed. Additional data were obtained on erosion, corrosion, and mass transfer in circulating bismuth, bismuth alloy, and bismuth alloy slurry systems. The solubilities of a number of fission products in liquid bismuth were determined. An electrolytic method was developed for forming thorium bismuthide dispersions. Results are given from studies of uranium dissolution in bromine trifluoride. Radiation induced graft copolymerization was also investigated. Isotope separation and purification problems are reviewed. (For preceding period see BNL-434.) (D.E.B.)

7837 BNL-477
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] MAY 1–SEPTEMBER 30, 1957. F. Maslan, ed. 82p. $2.25(OTS).

Thermal neutron diffusion lengths in bismuth were measured, and measurements on bismuth–graphite lattices were started. Uranium–fused salt phase and distribution studies were continued. A standard cell was designed for determining solute concentrations in fused chloride mixtures and liquid bismuth solutions. Absorption spectroscopy shows promise as a method for determining the concentration of uranium in fused chloride mixtures. Both theoretical and experimental studies were made of xenon removal problems in the Liquid Metal Fuel Reactor. Corrosion studies were made using a number of possible materials for use with fused magnesium chloride–potassium chloride–sodium chloride systems. Further studies of bismuth–thorium alloy preparation are reported. The operational status and available results are given from a number of corrosion loop studies with fused salts and liquid metal alloys. Dissolution rates are given for uranium in bromine trifluoride; Zircaloy clad molybdenum–uranium alloy, niobium–uranium alloy, and thorium oxide in phosphoric acid; and Zircaloy in sulfuric acid. (For preceding period see BNL-472.) (D.E.B.)

7838 BW-7065
Babcock and Wilcox Co. Research Center, Alliance, Ohio.
SODIUM BONDING OF APDA BLANKET ELEMENTS. Paul C. Thys and Dale W. Koch. Nov. 29, 1957. 29p. $4.80(ph OTS); $2.70(mf OTS).

A method was developed for satisfactorily bonding stainless steel cladding to uranium rod for use in the Fermi Fast Breeder Reactor blanket. The process is described, equipment used is shown, and a production flow diagram is proposed. (D.E.B.)

7839 ISC-903
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN METALLURGY FOR JANUARY–JUNE 1957. Dec. 20, 1957. 57p. Contract W-7405-eng-82. $1.50(OTS).

Study of the equilibrium phases which exist in Mg-rich alloys of the Mg–U–Th system was continued. The precipitation of thorium as thorium dihydride from thorium–magnesium solutions was investigated over the temperature range 665 to 810°C. Soft, ductile niobium metal can be prepared by mixing essentially stoichiometric quantities of

Nb_2O_5 and carbon, but slight deviation from stoichiometry yielded metal which was hard and non-ductile. The Zn vapor pressures over a number of Zn–Zr alloys were measured, and the results are summarized. An investigation of the U–Cr alloys was undertaken to establish the phase diagram and to determine the degree of ductility of some of the intermediate compositions. Alloys containing additions of small amounts of yttrium to tantalum, niobium, molybdenum, titanium, vanadium, and zirconium were continued in corrosion tests. The structure of the α-phase compound in the V–Al alloy was determined. The heat capacity of sodium tungsten bronze (Na_xWO_3) was measured over the temperature range 1.8 to 4.2°K for various concentrations of sodium. Measurements of the elastic constants of single crystals of metallic Be as a function of temperature are in progress. Tensile tests were carried out on standard 0.252 in. diameter tensile specimens prepared from bomb-reduced vanadium. An investigation of the fabrication properties of yttrium metal was initiated to determine the cold working characteristic of the metal and of the effect of impurities upon this property. (For preceding period see ISC-835.) (W.L.H.)

7840 KAPL-M-RLM-14

Knolls Atomic Power Lab., Schenectady, N. Y.

INTERIM PROGRESS REPORT ON THE CREEP-RUPTURE PROPERTIES OF ZIRCALOY. PART B. EXTRUDED AND ANNEALED ZIRCALOY-2. R. L. Mehan and F. W. Wiesinger. Mar. 20, 1958. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Stress-rupture tests of atmosphere melted, extruded, and annealed Zircaloy-2 were performed in helium at 600, 700, and 800°F. Rupture values, minimum creep rates, and time to various amounts of total deformation are shown as a function of applied stress. Low-temperature values seem appreciably higher than previously reported data for sheet material but drop off more rapidly with temperature. (For preceding period see KAPL-M-RLM-11.) (auth)

7841 NACA-TN-4224

Michigan. Univ., Ann Arbor.

EFFECT OF OVERHEATING OF CREEP-RUPTURE PROPERTIES OF M-252 ALLOY. John P. Rowe and J. W. Freeman. July 31, 1956. 83p.

The effects of overheats to temperatures of 1,650, 1,800, 1,900, and 2,000°F were evaluated in terms of the changes in creep-rupture properties at 1,500°F of M-252 alloy under stresses within the range of rupture strengths of the alloy for 80 to 1,000 hr. Overheat periods were predominantly of 2-min duration and were applied cyclically at approximately 5- or 12-hr intervals. The results are compared with results of similar tests on S-816 and HS-31 alloys. (auth)

7842 NMI-1195

Nuclear Metals, Inc., Cambridge, Mass.

QUARTERLY PROGRESS REPORT TO THE AEC RESEARCH DIVISION FOR THE PERIOD JULY 1, 1957 THROUGH SEPTEMBER 30, 1957. Dec. 13, 1957. 13p. Contract AT(30-1)-1565. $0.50(OTS).

A brief description is given of work concerning the solubility of other metals in any of the four solvents in each of two quartets surveyed: Hg, Tl, Pb, and Bi; and Cd, In, Sn, and Sb. Studies of evaporation from metal surfaces under irradiation have continued, concentrated especially on specimens previously prepared at NMI and irradiated for one month in the CP-5 reactor; handling and separation procedures are described. Further progress is reported in a continuing program concerning the effects of fast neutron irradiation on copper-iron precipitation-hardening alloys. Experiments to determine the behavior of metals during tandem extrusion are in their final stages, and articles on this subject are being prepared for journal publication. An outline is given of work to determine deformation modes, such as slip planes and twin planes, in zirconium and zirconium–oxygen alloys. (auth)

7843 NP-6640

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

COMPILATION OF AVAILABLE INFORMATION ON Ti–6Al–4V ALLOY. R. W. Douglass and F. C. Holden. Feb. 28, 1958. 185p.

Available data on fabrication, corrosion, heat treatment, mechanical properties, and metallurgy of Ti–6Al–4V alloy are summarized. 73 references. (J.E.D.)

7844 NP-6654

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE SHEAR MODULUS OF TITANIUM AND ITS ALLOYS. Mar. 31, 1958. 7p.

Tables of room- and elevated-temperature values are given. (D.E.B.)

7845 WADC-TR-54-546(Pt. II)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

PILOT PRODUCTION, FABRICATION AND EVALUATION OF PROMISING TITANIUM ALLOYS. Period Covered: April 1, 1955 to August 31, 1957. Frank A. Crossley, Benjamin R. Rajala, and David W. Levinson. Dec. 1957. 46p. Project title: METALLIC MATERIALS. Task title: TITANIUM METALS AND ALLOYS. Contract AF33(616)-2060. (AD-151010).

Approximately 300 pounds of Ti–7Al–3Mo alloy were fabricated to bar stock and distributed to various jet engine manufacturers. About 70 pounds of hot-rolled, centerless-ground bar was sent to Thompson Products, Inc. They were highly successful in manufacturing 140 J-57 7th stage compressor blades from this material. The endurance limit for blades bench-tested at room temperature under completely reversed stress was 75,000 psi, 5000 psi higher than Ti–6Al–4V alloy blades of the same configuration. Tensile properties for specimens cut from blades and heat treated: 1560°F-1/2 hour-air cooled, 1020°F-24 hours, were as follows: 170,000 psi ultimate tensile strength, 167,000 psi 0.2% offset yield strength, 49% reduction in area, and 16% elongation. As a result of the promising preliminary evaluations, Pratt and Whitney Aircraft, Division of United Aircraft, is preparing to engine test these blades. Johnston and Funk Titanium Corporation was successful in producing, on an experimental basis, wire in sizes down to 0.020 in. diameter from Ti–7Al–3Mo 9/32 in. diameter rod. No difficulty in supplying production quantities is anticipated. The high-strength condition produced by applying the heat treatment: 1800°F-1 hour-water quench, 1000°F-2 hours to equiaxed Ti–7Al–3Mo alloy material was found to be unstable to aging under stress at 800°F. Tests conducted by Eaton Manufacturing Company indicated that the alloy is stress-relieved by 2 hours at 1300°F. The Ti–7Al–3Mo alloy shows considerable promise. This is a fact implicit in the production by Cramet, Inc., of 1500 to 2000 pounds of Ti–7Al–3Mo material for sale, and the announcement by Rem-Cru Titanium, Inc., of the availability of experimental quantities of their version of the alloy containing 6½% aluminum and 3¾% molybdenum. (auth)

7846 WADC-TR-58-20

Manufacturing Labs., Inc., Boston.

DEVELOPMENT OF IMPROVED TITANIUM ALLOYS FOR APPLICATION AT ELEVATED TEMPERATURES. Period

Covered: February 1, 1957 to December 31, 1957. Bernard S. Lement. Jan. 31, 1958. 73p. Project title: DEVELOPMENT OF IMPROVED TITANIUM ALLOYS FOR APPLICATION AT ELEVATED TEMPERATURES. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-3986. (AD-151029)

A metallurgical investigation of the embrittling reaction that occurs in binary Ti–Al alloys was carried out in the range of 6 to 12 wt. % aluminum. Changes in bend ductility, hardness, precision length, electrical resistance, lattice parameters, and in microstructure that occur on solutionizing and aging were determined. It was found that the embrittling reaction that occurs on aging in the vicinity of 1020°F (550°C) is characterized by a decrease in both specific volume and electrical resistivity as well as a marked change in the character of striations that exist within the primary grains of the alpha solid solution matrix. The observed changes in properties are best explained on the basis that these striations represent the formation of aluminum-rich segregations. Evidence was found that cracking in a bend test occurs more readily along rather than across these striations. Recommendations are given for future work on this problem. (auth)

7847 WAPD-BT-6

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. BETTIS TECHNICAL REVIEW. REACTOR METALLURGY. Jan. 1958. 128p. Contract AT-11-1-GEN-14. $3.50(OTS).

The metallurgical design and properties of recently developed Ag–In–Cd alloys show considerable promise of fulfilling metallurgical, physical, and mechanical design requirements for PWR control rod. The Ag–15 wt. % In–5 wt. % Cd alloy, which is comparable to Hf in neutron absorption characteristics has remarkably high corrosion resistance permitting its use in pressurized water operation. Physical and mechanical properties of this alloy are described, and properties of full-size Ag–15 wt. % In–5 wt. % Cd PWR-type control rods are discussed. A brief study was undertaken to determine the relative solubility behavior of B and some of the more widely used compounds in high temperature water. The results of this study are presented along with the reactions involved. A series of photomicrographs has been prepared to show structures that are typical of Zr, Zircaloy-2, and Zircaloy-3 ingots and hot-rolled strips. The differences in the microstructure of these materials are enumerated to aid in the metallographic differentiation of any one of these materials from the other two. A study of the effects of heat-treating temperatures and cooling rates on the corrosion resistance of Zircaloy-2 and Zircaloy-3 is presented. Typical photomicrographs are presented to illustrate the results of this study. Successful chemical displacement plating of various metals onto Zircaloy was accomplished. A number of metals and combinations of metals were used under various conditions. Results showed that displacement plating, particularly with Ni, will be useful for a number of reactor applications. An investigation was made to determine the amount of U naturally present in Zr and Zircaloy scrap, the various effects of this amount, and the level of U contamination which can be tolerated. Samples of irradiated UO_2 which varied in preparation and composition were studied. Lattice parameter measurements were made, and an analysis of the x-ray-diffraction line-broadening observed was performed. A comparison between the behavior of UO_2 and U_3O_8 under irradiation is made. Irradiation tests of PWR-type fuel rods in the X-1 loop of the NRX Reactor resulted in fusion and grain growth in the center of the UO_2 fuel under thermal conditions at which such excessive structural changes were not expected. The data from these tests are used to revise the calculated temperature–heat flux relationships for this type of fuel element. The nature and effects of melting of the UO_2 are discussed. (W.L.H.)

7848 WAPD-CTA(ED)-18

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
WEAR AND FRICTION OF MATERIALS ON THE PENDULUM SLIDE MACHINE. N. B. Dewees. Nov. 23, 1955. 45p. Project 26c15. Contract AT-11-1-GEN-14. $7.80 (ph OTS); $3.30(mf OTS).

Seven different materials were tested against one another for wear and friction under various loads in room-temperature water open to the atmosphere. Both 17-4 PH stainless and Haynes 25 were tested with two different hardness values. From the standpoint of the probability of avoiding high friction under these conditions, 17-4 PH stainless is the worst material tested; Stainless 304 and Inconel-X are a close second. Stellite 3 and Haynes 25 (46 R_c) are in an intermediate position, and chrome plate has the best chance of having a low coefficient. (auth)

7849 WAPD-NCE-7532

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PROGRESS REPORT ON METALLURGICAL STUDIES OF ZIRCONIUM ALLOYS. [Period Covered]: November 15, 1957 to February 15, 1958. J. G. Goodwin, J. D. Grozier, L. S. Rubenstein, and F. L. Schubert. Feb. 15, 1958. 41p. $7.80(ph OTS); $3.30(mf OTS).

The structure, factors affecting the corrosion resistance, and effects of various gas additions on the properties of Zircaloy-2 are described. Brief descriptions of the work done by subcontractors on metallurgical studies of zirconium alloys are included. (For preceding period see WAPD-NCE-7002.) (W.L.H.)

7850 WAPD-ZH-1 and WAPD-ZH-2

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ZIRCONIUM HIGHLIGHTS, NOVEMBER, DECEMBER 1957. (Nov. 26p. and Dec. 51p.) Contract [AT-11-1-GEN-14]. (WAPD-ZH-1, $4.80(ph OTS); $2.70(mf OTS) and WAPD-ZH-2, $7.80(ph OTS); $3.30(mf OTS).)

These two reports were issued separately, but are cataloged as a unit.

The following investigations of Zircaloy were made: hydrogen analysis; vacuum vs. atmosphere melting; microstructural appearance of stringers; alpha to alpha-plus-beta transformation temperature; cold-swaging; metallographic etchant; sulfuric acid rinsing after pickling; occurrence of excessive grain growth; anodizing as a technique for determining the origin of stringers; calculation of the diffusion of gaseous contaminants; and effect of removal of surface metal. (W.L.H.)

7851 WAPD-ZH-3, WAPD-ZH-4, and WAPD-ZH-5

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ZIRCONIUM HIGHLIGHTS, JANUARY, FEBRUARY, MARCH, 1958. (Jan. 27p.; Feb. 29p.; and Mar. 17p.). Contract [AT-11-1-GEN-14]. (WAPD-ZH-3 and WAPD-ZH-4, $4.80(ph OTS); $2.70(mf OTS) ea.; and WAPD-ZH-5, $3.30(ph OTS); $2.50(mf OTS).)

These three reports were issued separately, but are cataloged as a unit.

The following investigations of Zircaloy were made: fusion welding of vacuum-melted; source of stringer corrosion; effect of stretch straightening on grain size of tubing; crevice corrosion; status of arc-melting; dissolution of oxide films; conversion of ingots to cold-rolled strip; effect of heat treatment on the tensile and corrosion properties; variations in yielding behavior caused by

hydrogen; corrosion evaluation of hydrogen during corrosion in high-temperature water and steam; and corrosion evaluation of hydrochloric–hydrofluoric acid etchant. (W.L.H.)

7852 TIL/T-4756

ELECTRONIC METHODS OF RAPID NON-DESTRUCTIVE TESTING OF METALS. (Methodes Electroniques de Controle Rapide et Non-Destructif des Metaux). G. H. Dion and R. Usquelis. Translated from Ingén. et Tech. 83, (1955) Dec. 14p. (AD-132217)

7853

INFLUENCE OF THE TEMPERING CONDITIONS ON THE PRE-PRECIPITATION IN Al–Zn ALLOY WITH 10% Zn. René Graf. Compt. rend. 246, 1544-7(1958) Mar. 10. (In French)

When the alloy is tempered beginning at different temperatures, the speed of hardening is a maximum at 460°. This corresponds to a maximum dimension of the pre-precipitation zone. The existence of pores retained during tempering permits the interpretation of the results. (tr-auth)

7854

ON THE EVOLUTION OF THE QUADRATIC ZIRCONIA STRUCTURE CAUSED BY THE DISSOLUTION OF SMALL QUANTITIES OF EXTRANEOUS OXYGEN. Jochen Stocker, Robert Collongues, and Monique Moser. Compt. rend. 246, 1698-1701(1958) Mar. 17. (In French)

It is shown that the dissolution in zirconium oxide of small quantities of extraneous oxygen causes a continuing modification to the quadratic form. According to the nature of the oxide addition, the crystalline form evolves toward a cubic structure, or toward a more deformed structure. (J.S.R.)

7855

DEVELOPMENT OF PREFERRED ORIENTATIONS IN SILICON IRON. J. R. Brown (G. K. N. Group Research Lab., Wolverhampton, Eng.). J. Appl. Phys. 29, 359-60 (1958) Mar.

The (110) [001] texture in silicon iron arises by a process of secondary recrystallization after cold reduction of the strip in two stages separated by an anneal. It is possible to produce the same texture by a one-stage or a three-stage reduction process. The rolling textures and primary recrystallization textures for each of these processes have been experimentally determined and are all different. In spite of this, the (110) [001] secondary orientation develops in each case. It is tentatively suggested that impurities in the steel, already known to be important in controlling grain growth in silicon iron, also supply the directional forces leading to the (110) [001] texture. (auth)

7856

(110) [001] SECONDARY RECRYSTALLIZATION TEXTURE IN THREE PERCENT SILICON–IRON. H. C. Fiedler (General Electric Co., Schenectady, N. Y.). J. Appl. Phys. 29, 361-2(1958) Mar.

The secondary recrystallization texture has been related to the structure developed during prior processing. The (110) [001] component of the primary recrystallization texture, from which secondary grains grow, develops from the (111) (112) doublet component in the prior recrystallization texture. If the material undergoes two rather than one prior recrystallization heat treatments (each separated by a cold reduction), the amount of the (110) [001] component in the primary recrystallization texture is in general increased, and as a consequence, the completeness of secondary recrystallization is promoted. (auth)

7857

MAGNETIC PROPERTIES OF CUBE TEXTURED SILICON–IRON MAGNETIC SHEET. J. L. Walter, W. R. Hibbard, H. C. Fiedler, H. E. Grenoble, R. H. Pry, and P. G. Frischmann (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 29, 363-5(1958) Mar.

Cube textured magnetic sheet containing approximately 3% silicon in iron has been developed in the General Electric Company Research Laboratory. The magnitude of the cube texture as determined by torque magnetometer tests is of the order of 90% or greater when compared to a single crystal with a (100) [001] orientation. The magnitude of the texture was confirmed by x-ray-diffraction pole figures. Static d-c magnetic tests and 60 cycle a-c w-loss tests made on single strip samples taken both parallel to the rolling direction and at right angles to the rolling direction indicate nearly equal magnetic properties in both directions of the sheet. These properties are equivalent to the magnetic properties measured in the single good direction of the "grain oriented" transformer material. Finally, two transformers were made: one using laminations of the cube textured silicon iron, the other of the "grain oriented" material. It was found that transformer made of the cube textured material produced significantly lower energy losses at all inductions and at 17 000 gauss the losses were approximately 60% of the losses produced by the "grain oriented" transformer. Similarly the current required to produce 17 000 gauss in the cube textured transformer was again about half that required to excite the "grain oriented" transformer to the same induction. (auth)

7858

CUBE TEXTURE IN BODY CENTERED MAGNETIC ALLOYS. G. Wiener, P. A. Albert, and R. H. Trapp (Westinghouse Electric Corp., Pittsburgh) and M. F. Littmann (Armco Steel Corp., Pittsburgh). J. Appl. Phys. 29, 366-7(1958) Mar.

Cube oriented, (100) [001], iron–silicon alloys have been prepared in thickness ranging from 0.8 mil to 11.0 mils. Both a-c and d-c magnetic properties are given for the alloys. The data show that comparable properties to commercial singly oriented steel of the (110) [001] texture are obtained both parallel and perpendicular to the rolling direction. The magnetic properties are sensitive to both the amount of cube oriented grains and the distribution of the directions about the rolling direction of the sheet. (auth)

7859

LOW RESIDUAL INDUCTION IN HIGH-ALUMINUM IRON ALLOYS. D. Pavlovic and K. Foster (Westinghouse Electric Corp., East Pittsburgh). J. Appl. Phys. 29, 368-9 (1958) Mar.

Low values of residual induction have been observed for different heat treatments in 0.007 and 0.014 in. thick sheets of aluminum–iron alloys containing 10 to 16 weight percent aluminum. For these materials the ratio of residual induction (B_r) to induction at 100 oersteds (B_{100}) gave values of 0.05 to 0.1. These low residual induction values apparently occur at compositions having zero crystal anisotropy for both furnace-cooled and water-quenched alloys. Domain patterns were observed in these low B_r alloys, but, in general, no evidence of domain patterns was observed in the same alloys when the B_r/B_{100} ratio was increased, through suitable heat treatment, to a value greater than about 0.2. The fairly high magnetostriction of the alloys around the Fe_3Al composition and the stress produced by cooling through differently ordered regions may be considered to produce a high "stress anisotropy" resulting in

pronounced domain patterns and perhaps also to contribute to the lowering of the residual induction of these alloys. (auth)

7860

EFFECT OF ELASTIC BENDING ON MAGNETIC PROPERTIES OF ORIENTED SILICON IRON. R. W. Cole (Crucible Steel Co. of America, Pittsburgh). J. Appl. Phys. 29, 370-1(1958) Mar.

To determine how the a-c and d-c magnetic properties are affected by elastic strain, the magnetic properties in the rolling direction of Epstein strips of elastically bent grain-oriented 3% silicon iron were measured in an Epstein frame and in a Carr single-strip permeameter. As the degree of bending becomes more pronounced, the coercive force and the a-c core loss increase and the permeability decreases. The domain theory gives a rather simple approximate interpretation of the permeability data for magnetic intensities between one and ten oersteds. (auth)

7861

MAGNETOMETALLURGY — APPLICATIONS AND TECHNIQUES. Anthony Arrott (Ford Motor Co., Dearborn, Mich.). J. Appl. Phys. 29, 508-12(1958) Mar.

The use of measurements of intrinsic magnetic properties — susceptibility, saturation magnetization, and transition temperature — in solving problems in metallurgy is discussed. Applications to phase-diagram determinations, precipitation studies, kinetics, detection of inhomogeneities, and quantitative analysis are considered. Methods of measurement requiring little capital investment are pointed out in the hope of stimulating metallurgy graduate students to apply magnetic analysis to their problems. (auth)

7862

ELECTROLYTIC CELL FOR HIGH TEMPERATURES. G. Chauvin, H. Coriou, and J. Hure (Centre d'Etudes Nucléaires de Saclay, France). Metaux(Corrosion–Inds.) No. 377, 8p(1957) Jan. (In French)

A detailed description of an electrolytic cell, designed for the electrolytic preparation of metals of very high purity, is given. The cell permits degassing, before the electrolysis, at high temperature (800 to 1000°C) and in vacuum. After the electrolysis the cathodic deposit is cooled either in air or under an inert atmosphere. The application of this cell to the purification of zirconium is discussed. (J.S.R.)

7863

THE OBSERVATION OF VACANCY SOURCES IN METALS. R. S. Barnes, G. B. Redding, and A. H. Cottrell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 97-9(1958) Jan.

Helium atoms have been injected into copper by alpha-particle bombardment in a cyclotron. On subsequent heating, the helium precipitates out as small gas bubbles in those parts of the metal where the helium atoms receive vacancies from nearby sources. From the distribution of the gas bubbles it is concluded that grain boundaries are effective sources of vacancies, but twin boundaries are not. Isolated sources of vacancies exist within the crystals, but there is no evidence that the dislocation network generates appreciable numbers of vacancies. (auth)

7864

THE ULTIMATE DISTRIBUTION OF IMPURITY IN THE ZONE-MELTING PROCESS. L. W. Davies C.S.I.R.O., Sydney). Phil. Mag. (8) 3, 159-62(1958) Feb.

The ultimate distribution of a given impurity in a metal ingot after the passage of an infinite number of molten zones was determined analytically. (A.C.)

7865

ELECTROMAGNETIC STIRRING IN ZONE REFINING. I. Braun, F. C. Frank, S. Marshall, and G. Meyrick (Univ. of Bristol, Eng.). Phil. Mag. (8) 3, 208-9(1958) Feb.

The efficiency of the zone refining process can obviously be increased by stirring the molten zone to disperse the impurity-rich layer at the solid-liquid surface. Induction heating is sometimes preferred to radiant heat because it produces more convection; but no marked improvement has been reported. Pfann and Dorsi(1957) have described a method of stirring the melt by passing an electric current through the ingot and impressing a magnetic field across the molten zone. Preliminary results obtained by using a rotating magnetic field as the stirring agent during the purification of aluminum are described. (A.C.)

PHYSICS

Refer also to abstract 7645.

7866 ISC-926

Ames Lab., Ames, Iowa.

MEASUREMENT OF MINORITY CARRIER LIFETIMES IN SEMICONDUCTORS. Yuichiro Nishina and G. C. Danielson. Mar. 1957. 39p. Contract W-7405-eng-82. $1.25 (OTS).

The bulk lifetimes of minority carriers in n-type germanium, in both n and p-type silicon, and in n-type magnesium germanide were investigated at room temperature. The sample was illuminated with periodic light flashes produced by a spark gap. The transient change in conductance of the sample after illumination gave the lifetime. In germanium and silicon the measured bulk lifetimes had values from 15 to 140 μsec with estimated errors of 4 to 15%, respectively. It was not possible to measure the lifetime in magnesium germanide because the particular sample used in this experiment was not sufficiently pure. The general solution of the equation of continuity for the minority carriers in a rectangular sample has been obtained. The particular solution for the boundary and initial conditions of this experiment are discussed. (auth)

7867 LA-2000

Los Alamos Scientific Lab., N. Mex.

BLAST WAVE. Hans A. Bethe, Klaus Fuchs, Joseph O. Hirschfelder, John L. Magee, Rudolph E. Peierls, and John von Neumann. Aug. 1947. 301p. Contract W-7405-eng-36. $6.50(OTS).

This report supersedes LA-1020 and part of LA-1021.

A general description of a blast wave caused by an explosion is given along with a mathematical analysis of a blast wave. The thermal radiation phenomena of a nuclear explosion are described mathematically. Approximations for small γ-1, asymptotic theory for small blast pressure, the IBM solution of the blast wave problem, and the equation of state of air are presented. (W.L.H.)

7868 MLM-CF-57-8-27

Mound Lab., Miamisburg, Ohio.

NUCLEAR BATTERY — THERMOCOUPLE TYPE. Quarterly Report No. 2 [for] April 1, 1957 to June 30, 1957. Bertram C. Blanke. June 30, 1957. 9p. DA Project No. 3-99-09-00. Contract R-50-799965-SC-01-91.

One prototype thermoelectric generator was designed and built. This generator, with 120 junction pairs, was found unsatisfactory when tested because of break down of electrical insulation between the heat source and the junctions. Other designs and materials are being investigated. (For preceding period see MLM-CF-57-4-34.) (auth)

7869 MLM-CF-58-1-40
Mound Lab., Miamisburg, Ohio.
NUCLEAR BATTERY — THERMOCOUPLE TYPE. Quarterly Report No. 4 [for] October 1, 1957 to December 31, 1957. Bertram C. Blanke. Dec. 31, 1957. 41p. DA Project No. 3-99-09-00. Contract R-50-799965-SC-01-91.

A study has been made and a series of general equations have been derived for the theory of the thermoelectric generator. A new thermoelectric generator has been designed and is being constructed. (For preceding period see MLM-CF-57-10-31.) (auth)

7870 ORNL-2030(Del.)
Oak Ridge National Lab., Tenn.
ELECTRONUCLEAR RESEARCH DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 20, 1955. F. T. Howard, ed. Feb. 13, 1956. Decl. with deletions May 7, 1957. 39p. (Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

The installation of the beam deflector in the ORNL 86-inch Cyclotron is sufficiently complete to allow initial testing; the system permits the optional use of high-current internal targets. A survey of (n,α) cross sections made with 14-Mev neutrons indicates qualitative agreement with statistical theory. An internal-conversion spectrograph and a fission-fragment spectrograph were built and put in operation. The excitation functions for several proton-induced reactions of possible use in isotope production were measured. A capsule-type target is being used for the irradiation of chemical compounds. Nuclear physics research with 26-Mev nitrogen ions from the ORNL 63-inch Cyclotron concerned the following: a theoretical interpretation of elastic nitrogen-nitrogen scattering; a detailed investigation of some nitrogen-nitrogen nuclear reactions; the measurement of reaction cross sections in B and Al; and the identification and the energy spectra of protons and alpha particles resulting from nitrogen-induced reactions with light elements. A study is being made of the practicability of a fixed-frequency cyclotron to accelerate protons to about 1 Bev for application in meson research. Phase compensation would be obtained with an unusual magnetic-field configuration which has 8 azimuthal cycles with about 72° of spiral. Also, a proposal was made to convert the 44-in. proton cyclotron; a new 48-in. magnet would permit the acceleration of heavy ions to energies up to 81 Mev. Further successful calutron operation has increased the quantities of enriched isotopes of Pu available for research studies. New techniques were developed to prevent the holdup of Pu in processing equipment. Work on the APPR-1 is progressing on schedule, and arrangements were made to advance the completion date from December, 1957 to July, 1957. The contractor's design for the APPR-1 plant was approved by the Advisory Committee on Reactor Safeguards, and the contractor has started the initial phases of construction at Fort Belvoir, Virginia. Critical experiments and other supporting development work at the Laboratory are proceeding on schedule. (For preceding period see ORNL-1884.) (auth)

7871 AEC-tr-2931
SOLUTION OF CERTAIN PROBLEMS ON DETONATION IN A MEDIUM WITH VARIABLE DENSITY. I. M. Yavorskaya. Translated from Doklady Akad. Nauk S.S.S.R. 111, 783-6(1956). 10p.

7872
THE VAPOR PRESSURE OF POLONIUM AT ROOM TEMPERATURE. J. Auslănder and Iulia Georgescu. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 17-23(1957). (In Romanian)

Preliminary results of experiments carried out with nuclear research plates show an order of magnitude of $\sim 0.5 \cdot 10^{-14}$ mm Hg for the vapor pressure of polonium at room temperature. (auth)

7873
RESONANT MODES OF FERROMAGNETIC SPHEROIDS. L. R. Walker (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 29, 318-23(1958) Mar.

The spectrum of modes of oscillation of a ferromagnetic spheroid situated in a uniform d-c magnetic field is discussed. It is shown that, for the size of sample usually used in microwave experiments, a part of the spectrum consists of magnetostatic modes for which exchange and propagation may be ignored. The behavior of these modes is discussed at some length and it is shown that the analysis gives a satisfactory description of the observed absorption curves. (auth)

7874
LOW-TEMPERATURE SPIN-WAVE RESONANCE AT 3000 AND 4000 Mc/sec IN A PERMALLOY HAVING NEARLY ZERO MAGNETOCRYSTALLINE ANISOTROPY. J. R. Weertman and G. T. Rado (U. S. Naval Research Lab., Washington). J. Appl. Phys. 29, 328-9(1958) Mar.

The observation of spin-wave resonance in Permalloy samples of extremely low anisotropy has been extended to liquid nitrogen temperature. Measurements at both room and liquid nitrogen temperature have been carried out at 3000 and at 4000 Mc/sec. At room temperature the complete experimental resonance curve can be explained at both frequencies on the basis of the spin-wave resonance theory of Ament and Rado by using an average exchange stiffness constant, A, of $(3.3 \pm 0.5) \times 10^{-6}$ erg/cm and a g factor of 2.06 ± 0.01. The agreement between experiment and theory would be destroyed if a Landau-Lifshitz or Bloch damping term were included. The theory of Ament and Rado predicts that as the temperature is lowered the exchange broadening of the resonance line increases and the resonance field decreases. Both effects have been observed qualitatively but neither is as would be expected from the theory. It has been found that at a given temperature the plot of the imaginary versus real part of the equivalent permeability at 3000 Mc/sec differs only by a scale factor from the corresponding plot at 4000 Mc/sec. At room temperature the above frequency increase causes a decrease in the permeabilities of 30% from the corresponding values at 3000 Mc/sec, as compared to a predicted 15% decrease. The discrepancy between theory and experiment at the low temperature is about the same at one frequency as at the other. Since the corresponding resonance fields differ by a factor of two, any effects due to incomplete saturation seem to be ruled out. (auth)

7875
EFFECT OF ELECTRONIC MEAN FREE PATH ON SPIN-WAVE RESONANCE IN FERROMAGNETIC METALS. George T. Rado (U. S. Naval Research Lab., Washington). J. Appl. Phys. 29, 330-2(1958) Mar.

It is suggested that under certain conditions the interpretation of ferromagnetic resonance phenomena in metals should not make use of Ohm's law because the electronic mean free path may not be negligible in comparison to an appropriately defined effective skin depth. Such conditions can exist even at moderately low temperatures provided the equivalent permeability is sufficiently large. The anomalous effects due to the mean free path are shown to be particularly important in spin-wave resonance, i.e., in a modified ferromagnetic resonance which is appreciably influenced by the exchange interactions existing in the skin depth. A suitable perturbation method is developed for calculating these anomalous effects on the basis of Maxwell's equations and the spin-wave equation. Using a relation proposed by Reuter and Sondheimer, a simple first-order

result is then obtained for the surface impedance and for the equivalent permeability derived therefrom. The limitations of the underlying physical model are pointed out, and the applicability of the theory to existing experimental results is briefly discussed. (auth)

7876

ORIGIN OF FERROMAGNETIC RESONANCE LINE BROADENING IN MANGANESE-RICH MANGANESE FERRITES. S. E. Harrison, H. S. Belson, and C. J. Kriessman (Remington Rand Univac, Philadelphia). J. Appl. Phys. 29, 337-8(1958) Mar.

Ferromagnetic resonance line widths in dense polycrystalline and single crystal specimens, the magnetic moment and the anisotropy field (K_1/M_s) have been measured as a function of temperature. Between room temperature and the Curie point the excess resonance line width, which is given by $\Delta H(\text{excess}) - \Delta H(\text{polycrystal}) - \Delta H(\text{single crystal})$, is found to have the same temperature dependence as the saturation magnetization. This result is obtained even though the polycrystalline density (>98%) is sufficiently high to be in the range where the excess line width has usually been attributed to anisotropy broadening. In the region below room temperature ΔH(excess) becomes dependent on the anisotropy field. An approximate criterion, that is suggested by the data, to determine whether the anisotropy field or the magnetic moment is responsible for the broadening is the ratio $K_1/M_s^2 \gtrsim 0.25$. The compositions measured were $Mn_{1.24}Fe_{1.76}O_4$ and $Mn_{1.49}Fe_{1.51}O_4$. The polycrystalline g factor (g_p) is greater than the single crystal g factor (g_s) and both g factors are functions of the temperature. The shift in the polycrystalline resonance peak is discussed with reference to the Standley Stevens theory and limited agreement is found. The anisotropy constant, K_1, has been found to vary as the fifth power of M_s for these ferrite compositions. (auth)

7877

FERROMAGNETIC RESONANCE IN UNIAXIAL POLYCRYSTALLINE MATERIALS. C. A. Morrison and N. Karayianis (Diamond Ordnance Fuze Lab., Washington). J. Appl. Phys. 29, 339-40(1958) Mar.

A theoretical determination is made of the resonance curve of a nonconducting polycrystalline ferromagnetic material with uniaxial crystalline anisotropy. A finite intrinsic line width is assumed for the single crystal, and effects of grain boundaries, impurities, inhomogeneities, and volume and surface divergence of the magnetization are ignored. The results are compared qualitatively with experiment. (auth)

7878

FERROMAGNETIC RESONANCE IN POLYCRYSTALLINE NICKEL FERRITE ALUMINATE. E. Schlömann and J. R. Zeender (Raytheon Mfg. Co., Waltham, Mass.). J. Appl. Phys. 29, 341-3(1958) Mar.

Line broadening because of crystalline anisotropy and the random orientation of the crystallites is investigated for the case in which the anisotropy field is much larger than the saturation magnetization. The theory predicts an absorption line with shoulders on each side which correspond to grains in which a hard or an easy direction is aligned with the dc field. With increasing anisotropy the low-field side of the line becomes more prominent and for $\gamma H_a/\omega \gtrsim 0.5$ a secondary absorption peak occurs on the low-field side of the main resonance. Measurements in nickel ferrite aluminates at X band agree reasonably well with the predictions, if it is assumed that the first order anisotropy constant is negative and that all higher order anistropy constants are zero. (auth)

7879

MAGNETIC ANISOTROPY INDUCED BY MAGNETIC ANNEALING AND BY COLD WORKING ON Ni_3Fe CRYSTAL. Soshin Chikazumi (Gakushuin Univ., Tokyo). J. Appl. Phys. 29, 346-50(1958) Mar.

Anter a brief report on the experiments which have been made on magnetic annealing, recent investigations on the magnetic anisotropy which is induced by cold rolling are described. The local and the average anisotropy induced by rolling was observed by means of domain pattern and torque measurement for (110)[001], (001)[110], (001)[100] rolling of single crystals and rolling of polycrystals. It was shown that the anisotropy for individual cases was well explained by assuming the "slip-induced directional order." Two types of anisotropy i.e., long-range order (fine slip) type and short range order (coarse slip) type, were calculated. Dependence on the degree of order and its difference between single and polycrystals are also discussed. (auth)

7880

EFFECT OF SAMPLE THICKNESS ON THE FIELD ANNEALING OF 6.5% Si-Fe. P. A. Albert (Westinghouse Electric Corp., East Pittsburgh). J. Appl. Phys. 29, 351-2(1958) Mar.

Iron alloys containing about 6.5 weight percent silicon are known to respond to heat treatment in a magnetic field. Since the degree of response has been observed to vary with sheet thickness, a study was made to better define this variation. Two different alloy compositions were cast in cylindrical molds. The ingots were drilled to form hollow cylinders which were sliced and polished to rings of final thicknesses of from 0.150-in. to 0.0025-in. dc hysteresis loops were measured on samples as annealed 2 hours at 1000°C in dry hydrogen, and as subsequently cooled at 40°C/hr from 900°C in a circumferential magnetic field of 10 oe. The differences in coercive force and maximum permeability between samples field annealed and not field annealed are thickness dependent, and are greater for thicker samples. The effects of thickness on coercive force are lessened by electropolishing, which greatly reduces the slope of the H_c vs (1/d)-durve for both the field-annealed and not field-annealed states. The maximum permeability is not found to be affected by electropolishing. (auth)

7881

ANTIFERROMAGNETIC STRUCTURES OF MnS_2, $MnSe_2$, and $MnTe_2$. L. M. Corliss, N. Elliott, and J. M. Hastings (Brookhaven National Lab., Upton, N. Y.). J. Appl. Phys. 29, 391-2(1958) Mar.

The antiferromagnetic structures of MnS_2, $MnSe_2$, and $MnTe_2$ have been obtained by neutron diffraction. The disulfide exhibts ordering of the "third" kind, the ditelluride, ordering of the "first" kind, and the diselenide, an arrangement which is intermediate between the two. The structures are discussed from the viewpoint of indirect exchange. (auth)

7882

APPRAISAL OF PERMANENT MAGNET MATERIALS FOR MAGNETIC FOCUSING OF ELECTRON BEAMS. Myron S. Glass (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 29, 403-4(1958) Mar.

In the magnetic focusing of electron beams there is a growing need for permanent magnets of higher coercive force than those which are easily obtainable. Special techniques in the design of compact tubular magnets for strong focusing fields enable the use of magnet materials of relatively low remanence. The low remanence of some materials suitable for this use has limited their general use and this has probably retarded their final development. There is a good potential demand for these materials for electron beam focusing which should stimulate increased development effort. (auth)

7883
PERFORMANCE OF PERMANENT MAGNETS AT ELEVATED TEMPERATURES. W. H. Roberts (General Electric Co., West Lynn, Mass.). J. Appl. Phys. 29, 405-7 (1958) Mar.

The objective of this investigation was to determine the effect of temperature up to 600°C and vibration on the performance of Alnico V and Alnico VI magnets. Data are presented on the effect of cycling stability, coefficient of remanence, extended exposure to elevated temperature and vibration. The results of this investigation show that the use of Alnico V and Alnico VI in most instrument and control applications is feasible up to 500°C. However, a considerable loss in properties should be expected if the temperature exceeds 500°C. (auth)

7884
SOME ASPECTS OF TEMPERING 3¼% SILICON STEEL AS FOLLOWED BY TIME DECAY OF PERMEABILITY. E. S. Anolick and Joseph Singer (General Electric Co., Pittsfield, Mass.). J. Appl. Phys. 29, 412-13(1958) Mar.

The time decay of permeability has been employed in the study of the distribution of interstitials (C,N) in 3¼% Si steel. In following the 150°C tempering of slowly cooled samples, a reversion phenomenon is noted. A method is discussed for obtaining the solubility of carbon over a limited range of temperature, with some preliminary results included. (auth)

7885
DOMAIN WALL MOTION IN METALS. R. W. DeBlois (General Electric Research Lab., Schenectady. N. Y.). J. Appl. Phys. 29, 459-67(1958) Mar.

A brief review on the ferromagnetic domain wall is first presented, touching on its energy and thickness, its coercive force, and its motion in metal loops, tapes, and wires, as governed by eddy currents and by relaxation processes. Next to be presented are the experimental results of an extension of the Sixtus-Tonks experiment to axial domain wall velocities over 50 km/sec. made possible by use of nearly perfect iron whiskers. Plots of axial velocity vs. applied field are nonlinear and in some cases show velocity discontinuities at room temperature in the region 3 to 8.5 km/sec. At 77°K velocity discontinuities beginning at 2 km/sec are observed. Nucleating fields of over 250 oersteds are indicated. Data analysis yields a relaxation damping coefficient, $\beta_1 \approx 10$ g/sec cm^2 for normal domain wall motion. (auth)

7886
THE ELECTRONIC STRUCTURE OF THE METALS OF THE FIRST TRANSITION PERIOD. W. M. Lomer and and W. Marshall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 185-203(1958) Feb.

Three distinct lines of experimental work now point towards a new conception of the electronic structure of the transition metals. Recent x-ray work has shown that in Fe and Cr the valence electrons are not as well localized near the atoms as had been supposed, while in Co, Ni, and Cu the compact 3d-shell is nearly complete. Saturation magnetic moments of Ni rich alloys show that Ti and V act as though they had respectively four and five electrons to contribute to the conduction band of Ni. Neutron diffraction evidence shows that pure Ti and V have no magnetic moments, ordered or disordered, and that in Ni–Cr alloys the Cr atom carries a moment not much different from Ni, though each added atom removes nearly 5 μb from the saturation moment. It is suggested that elements of atomic number less than Fe have few 3d electrons and many conduction electrons, while for those above iron this is reversed. It appears as though this conclusion can be maintained almost independently of crystal structure or composition of alloy. On this basis the variation of saturation magnetic moment of all the binary ferromagnetic alloys can be explained. (auth)

7887
CALCULATIONS OF SOLID-STATE DATA OF NEON, AND THE VAPOUR PRESSURE RATIO OF ITS ISOTOPES. T. F. Johns (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 229-36(1958) Mar.

Calculations have been made of the free energies and equations of state of solid Ne^{20} and Ne^{22}, using the method of Henkel. The vapor pressure ratio of the neon isotopes deduced from the calculated difference in their free energies is in excellent agreement with experimental measurements. Although the molecular volumes of the two isotopes differ by about 0.5%, the vapor pressure ratio can be calculated quite accurately on the assumption that there is no such volume effect; the reasons for this are explained. (auth)

7888
CELLULAR EIGENVALUES FOR TITANIUM METAL. S. L. Altmann and N. V. Cohan (Mathematical Inst., Oxford). Proc. Phys. Soc. (London) 71, 383-8(1958) Mar.

A program developed by Altmann for a high-speed computer to carry out cellular computations for close-packed hexagonal metals has been applied to titanium. The eigenvalues and eigenfunctions corresponding to all states for $k = 0$ have been determined, and the effect on these results of the type of potential field used has been investigated. (auth)

7889
IONIC CONDUCTION AT HIGH ELECTRIC FIELD STRENGTHS IN TANTALUM PENTOXIDE. A. R. Bray, P. W. M. Jacobs, and L. Young (Imperial Coll., London). Proc. Phys. Soc. (London) 71, 405-15(1958) Mar.

Polarization of the cell Ta|Ta_2O_5|Solution|Pt sets up a very high electric field strength in the oxide and ionic conduction (resulting in growth of the oxide film) occurs with negligible electronic conduction. With this cell measurements of field strength and current density have been made in the temperature range −63 to +90°C. These results are incompatible with single barrier control in which space charge is neglected but are consistent with a theory proposed by Dewald in 1955 in which space charge due to ions in transit causes the field in the oxide to vary through its thickness, so that barriers near the metal interface and within the oxide both play a part in controlling the rate of oxide formation. (auth)

7890
ON THE SYNTHESIS OF LINEAR SYSTEMS FOR TRANSMISSION WITHOUT DELAY, DELAYED AND LINEAR PREDICTION OF SIGNALS. II. Manuel Cerrillo V. (Instituto Nacional de la Investigación Cientifica Instituto de Matemáticas de la Universidad Nacional Autónoma de México). Rev. mex. fís 5, 71-133(1956). (In Spanish)

7891
ON THE SYNTHESIS OF LINEAR SYSTEMS FOR TRANSMISSION WITHOUT DELAY, DELAYED AND LINEAR PREDICTION OF SIGNALS. I. Manuel Cerrillo V. (Instituto Nacional de la Investigación Científica e Instituto de Matemáticas de la Universidad Nacional Autónoma de México). Rev. mex. fís. 4, 61-92(1955). (In Spanish)

Cosmic Radiation

7892
ON STATISTICAL ESTIMATION OF THE ENERGY OF SOFT CASCADES. E. Friedländer. Acad. rep. populare

Romîne, Inst. fiz. Studii cercetari fiz. 8, 153-6(1957). (In Romanian)

The average number of soft cascade shower particles hitting a countertray under a given thickness of lead is estimated from simultaneous coincidence records at different depths in the absorber. Expectance values and standard deviations are computed for a power spectrum and various coincidence arrangements. (auth)

7893

ON SOME FEATURES OF ENERGY TRANSFER IN HIGH-ENERGY NUCLEAR COLLISIONS. Erwin M. Friedländer (Inst. for Atomic Physics, Academy of the R.P.R.). Acad. rep. populare Romîne Rev. Phys. 11, 49-54(1957).

An attempt is made to compare Landau's theory and the kinematical model with the observed energy spectrum of the N component of cosmic rays. (J.S.R.)

7894

ON THE CHARGE AND ENERGY SPECTRUM OF HEAVY PRIMARIES IN COSMIC RADIATION. R. Cester, A. Debenedetti, C. M. Garelli, B. Quassiati, L. Tallone, and M. Vigone (Univ. of Turin). Nuovo cimento (10) 7, 371-99(1958) Feb. 1.

Several hundred tracks of heavy primaries in the cosmic radiation have been studied. Charge measurements have been carried out on all tracks with a photometric method, and independent checks with gap counting have been performed on boron and carbon tracks. All tracks have been followed through and a total of 331 nuclear collisions observed. From the analysis of these interactions, the interaction mean free paths, and fragmentation probabilities in emulsion and in air have been determined. The results are in good agreement with those of other workers and have been used to extrapolate the charge distribution at the top of the atmosphere: the ratios of light nuclei and of heavy nuclei to medium nuclei, at the top of the atmosphere, are 0.30 ± 0.09 and 0.51 ± 0.11 respectively. Results of energy determination on 275 tracks give a value $1.54^{+0.16}_{-0.13}$ for the exponent of the integral energy spectrum. Some difficulties in the application of Peters' relation between the energy of primary and the angles of emission of the fragmentation products are discussed. (auth)

7895

THE SIMPLE CONES OF ALBEDO OF COSMIC RAYS. R. Gall (Instituto de Geofísica, Instituto Nacional de la Investigación Científica, México) and J. Lifshitz (Instituto Nacional de la Investigacion Científica, Mexico). Nuovo cimento (10) 7, 601-6(1958) Mar. 1.

Simple albedo cones for 5 points of incidence were evaluated for dirrerent proton energies. The latitude, longitude, and energy effects are discussed. Some results are compared with those of Schremp. The altitude, above which the interaction with the atmosphere does not invalidate the results, is given. The validity of albedo model for different altitudes is discussed. The points of emission were studied. (auth)

7896

FURTHER INTERACTIONS OF THE HEAVY NUCLEI OF THE COSMIC RADIATION. V. Y. Rajopadhye and C. J. Waddington (H. H. Wills Physical Lab., Bristol, Eng.). Phil. Mag. (8) 3, 19-32(1958) Jan.

Earlier results obtained at Bristol from a study of nuclear interactions produced by heavy nuclei of the primary cosmic radiation passing through nuclear emulsions have been amplified and confirmed. Revised values are given for the fragmentation probabilities and mean free paths which are of greater statistical weight and in good agreement with those reported previously. Values are derived from the fragmentation probabilities in air and in hydrogen which probably represent upper limits to the true values. The implications of the results are discussed. (auth)

7897

TIME VARIATIONS OF THE COSMIC RAY INTENSITY IN JAMAICA. J. C. Barton and J. H. Stockhausen (Univ. Coll. of the West Indies, Jamaica). Phil. Mag. (8) 3, 55-62(1958) Jan.

A three-fold counter telescope has been used to study the radiation penetrating 10 cm of lead at a latitude of 18°N. A barometric coefficient of $-0.14 \pm 0.02\%$ per millibar was deduced from the semi-diurnal variation. The average counting rate decreased on days of high geomagnetic activity and at the same time there was a large increase in the diurnal variation. (auth)

7898

ANALYSIS OF NUCLEAR INTERACTIONS OF ENERGIES BETWEEN 1000 AND 100,000 Bev. B. Edwards, J. Losty, D. H. Perkins, K Pinkau, and J. Reynolds (Univ. of Bristol, Eng.). Phil. Mag. (8) 3, 237-66(1958) Mar.

Twenty nuclear interactions produced by protons and ten produced by α particles of energies above 1000 Bev have been analyzed. The proportion of pions among the secondaries is found to be 80% for the core and less than 70% for the wide angle tracks. The average transverse momentum resulting from the measurements is $p_T = 0.5$ Bev/c for pions and $p_T = 1$ to 2 Bev/c for heavy particles. It appears to be independent of angle of emission and primary energy. The multiplicity of the interaction, n_s shows no variation with primary energy; it varies, however, with the anisotropy of the angular distribution, and shows wide fluctuations at a fixed primary energy. The inelasticity, K, of the collisions is close to unity for secondary interactions of mean energy ~100 Bev and about 0.2 for jets produced by protons of energy ~10,000 Bev. At a fixed energy, K does not appear to be strongly dependent on n_s. None of the current theories appears capable of giving a satisfactory explanation of the experimental results, and an alternative model is proposed. (auth)

7899

ON THE STRUCTURE OF EXTENSIVE COSMIC RAY AIR SHOWERS: LATERAL STRUCTURE OF THE IONIZING COMPONENT. E. W. Kellermann, T. Shaw, and G. O. Walker (Univ. of Leeds, Eng.). Proc. Phys. Soc. (London) 71, 491-6(1958) Mar.

The lateral distribution of ionizing particles in extensive showers over the approximate range of size $5 \times 10^4 < N < 5 \times 10^5$ particles has been studied using a core-locating device (already described) to select showers, and unshielded 'probing' counter trays to estimate particle density at measured distances from the located shower axis. The distribution is determined with useful accuracy for four ranges of shower size. For the three greatest size ranges examined, the distribution is generally in accord with that of other workers and confirms the observation that for these showers structure does not vary significantly with shower size. For the range corresponding to the smallest showers, which are of a size for which accurate structure measurements have not previously been reported, it is found that the lateral structure shows evidence of significant aging of the effective cascade. (auth)

Crystallography and Crystal Structure

7900

GROWTH OF MAGNETIC GARNET CRYSTALS. J. W. Nielsen (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 29, 390-1(1958) Mar.

Single crystals of magnetic garnets have been grown from solutions of molten lead oxide, iron oxide, and the oxides of yttrium, samarium, erbium, or gadolinium. The crystals are grown by slowly cooling melts from 1325°C to near 900°C. A convenient composition is 52.5 mole % PbO, 44 mole % Fe_2O_3, and 3.5 mole % M_2O_3 where M is Y, Gd, Er, or Sm. Crystals of yttrium–iron garnet have been grown which contain gallium partially substituted for iron. The method may also be extended to the growth of non-magnetic yttrium gallium garnets by using a melt which is 72.7 mole % PbO, 26 mole % Ga_2O_3 and 1.3 mole % Y_2O_3. Bismuth oxide can be used as a solvent for the growth of magnetic garnet crystals but the substitution of bismuth in the garnet lattice makes it less desirable than lead oxide. (auth)

7901

SOME OBSERVATIONS ON CREEP IN ZINC SINGLE CRYSTALS. H. P. Stüwe (Univ. of Illinois, Urbana). J. Appl. Phys. 29, 566-9(1958) Mar.

A concentrated load, applied to the surface of a Zn single crystal, produces a hexagonal dimple if this surface is parallel to the basal plane of the crystal lattice. The rim of these dimples is formed by six sets of edge dislocations moving into the six slip directions with increasing loading time, thus causing the dimple to grow. The dimple contours can be photographed with a microfocus x-ray tube. Measurements of a large number of dimples showed: (1) For a given loading time, dimple size increases linearly with the applied load. (2) For a given load, dimple size increases with loading time until the shear stress at the dimple rim has been lowered to a value characteristic for the material used, below which creep velocity is either zero or extremely low. (3) This critical shear stress is independent of temperature. (4) It depends on the impurity concentration of the crystal in the way predicted by the model of Cottrell. (auth)

7902

X-RAY DETERMINATION OF THE THERMAL EXPANSION OF SINGLE CRYSTALS. V. V. Zubenko and M. M. Umanskiy. Kristallografiya 2, No. 4, 508-13(1957).

Two x-ray single-crystal goniometers fitted with arrangements for heating the specimen to a precisely determined temperature and measuring its lattice constants with high accuracy are described. Averaged over the range 20 to 270°C, the coefficients of expansion of corundum were found to be $5.6 \pm 0.1 \times 10^{-6}$ perpendicular to the axis and $6.6 \pm 0.1 \times 10^{-6}$ parallel to the axis. $a = 4.7483 \pm 0.0001$ and $c = 12.963 \pm 0.001$ KX at 22°C. For $Li_2SO_4 \cdot H_2O$ at 20 to 22°C $a = 5.455 \pm 0.002$ and $c = 8.1675 \pm 0.0006$ KX. In the c-direction the expansion coefficient is $15.6 \pm 0.5 \times 10^{-6}$, β does not change with temperature to ± 5′ and is 107.58°C. For d-potassium tartrate the dimensions were found to be $a = 15.458 \pm 0.004$, $b = 5.038 \pm 0.002$, $c = 20.054 \pm 0.002$ KX, $\beta = 90°50'$. The expansion coefficient $\alpha_{33} = 31.5 \pm 1.0 \times 10^{-6}$. (TCO)

7903

THE FINE STRUCTURE OF THE FILMS OF A NUMBER OF SHADOWING METALS OBSERVED UNDER HIGH RESOLUTION ELECTRON MICROSCOPE. S. N. Chatterjee (Inst. of Nuclear Physics, Calcutta). Naturwissenschaften 45, 106-7(1958).

Evaporated films of chromium, palladium, gold, uranium, platinum–iridium, and gold–palladium were studied with the aid of a high-resolution electron microscope to determine their suitability as shadowing metals. The thickness, contrast, and grain size of the films are tabulated. (J.S.R.)

7904

UNLOADING EFFECTS IN THE PLASTIC PROPERTIES OF COPPER SINGLE CRYSTALS. M. J. Makin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 287-301(1958) Mar.

Yield point phenomena occur on retesting copper single crystals during interrupted tensile deformation. The effect is observed only during the linear and parabolic regions of the stress–strain curve and the size of the yield drop is directly proportional to the reduction in stress on unloading. The ratio of the flow stress immediately before complete unloading to that on retesting is 0.986, and appears to be independent of temperature between −195°C and 100°C. The magnitude of the yield phenomenon at −195°C is markedly increased, however, by annealing at above −170°C, and this effect is independent of the amount of unloading. An explanation of these phenomena is advanced in which Lomer–Cottrell sessile dislocations are formed during unloading, and that it is these dislocations which prevent large scale reverse plasticity. The increased effect at −195°C on annealing is interpreted in terms of the thermally activated reversal of the apices of these sessile dislocations. (auth)

7905

THE TEMPERATURE DEPENDENCE OF FLOW STRESS IN COPPER SINGLE CRYSTALS. M. J. Makin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 309-11(1958) Mar.

The change in flow stress of copper single crystals has been measured over a range of strains by experiments in which the specimen was repeatedly tested at one temperature, unloaded and tested at another temperature (Adams and Cottrell, Phil. Mag. 46, 1187(1955)). In the present work the author repeats the experiments. The results indicate that Adams and Cottrell did not measure the true "reversible" change in flow stress but that their results also included the yield point by unloading. The present work confirms the observation that the corrected flow stress is almost independent of the temperature except for a "step" in the curve. (A.C.)

7906

DYNAMICS OF A CRYSTAL LATTICE CONTAINING ISOTOPES. Jean Pirenne (Inst. for Advanced Study, Princeton, N. J. and Université de Liege). Physica 24, 73-92(1958) Feb.

By means of a moment method, the vibration spectrum of a monoatomic crystal containing several isotopes, whose atoms are distributed at random throughout the lattice points, is obtained in terms of the solution of the conventional vibration problem of a single isotope crystal and in terms of the quantities $\langle \Delta\mu^p \rangle_{Av} = \Sigma_i c_i \Delta\mu_i^p = \Sigma_i c_i (\mu_i - \langle \mu \rangle_{Av})^p$, where c_i is the concentration of the i-th isotope and $\Delta\mu_i$ the deviation of its inverse atomic mass μ_i from the average value $\langle \mu \rangle_{Av} = \Sigma_i c_i \mu_i$. The frequency distribution is represented by a series development following the increasing powers of a heterogeneity parameter to which all the $\Delta\mu_i$ are assumed to be proportional. The first term is the frequency distribution of a fictitious crystal whose atoms would all have the mass $\langle \mu \rangle_{Av}^{-1}$. The next two terms are proportional to $\langle \Delta\mu^2 \rangle_{Av}$ and $\langle \Delta\mu^3 \rangle_{Av}$; the fourth term brings contributions in $\langle \Delta\mu^4 \rangle_{Av}$ and in $\langle \Delta\mu^2 \rangle^2$, etc. These three additional terms have been written down explicitly, but the following ones could be easily obtained. Each term but the first one brings contributions of the form $\int \delta'(\lambda - \lambda') K(\lambda') d\lambda'$, where λ is the square of the angular frequency. These functions may not be simply put equal to $K'(\lambda)$, as $K(\lambda)$ has singularities which must be carefully considered. In thermodynamic applications, however, this difficulty is irrelevant for then the δ' function is simply replaced by the λ-derivative of the desired thermodynamic function of the harmonic oscillator and the remaining integral is trivial. (auth)

Electrical Discharge

7907

DISTRIBUTION OF ELECTRON ENERGY IN A VERY HIGH FREQUENCY DISCHARGE IN HYDROGEN. F. Ciorăscu. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 41-53(1957). (In Romanian)

An attempt is made to interpret the experimental results concerning the existence of a maxwellian distribution of the velocity of free electrons in a high-energy discharge in hydrogen at low pressures and in weak fields. Agreement is shown between the values of the free electron density deduced from the characteristics of the Langmuir sound and deduced from the values of the active and reactive components of the impedance of the gas, calculated from the dispersion formula. It is shown that the two results can be supported at a given pressure by the frequency of the electron collisions. The frequency of the electron collisions differ only by a constant g which appears in the dispersion equation. The value of this factor can be obtained from measurement of the admittance complex component of the gas. The values g obtained in this manner are graphed. It is emphasized that the values are only constant in the case where the electron temperature is not too high. (tr-auth)

7908

A STUDY OF INTENSE PULSED GAS DISCHARGES BY HIGH-SPEED PHOTOGRAPHY. N. A. Borzunov, D. V. Orlinskii, and S. M. Osovets. Atomanya Energiya 4, 149-53(1958). (In Russian)

The basic processes taking place in the initial stages of intense gas discharges are described by comparing the current and intensity oscillograms with the high-speed photography of intense pulse discharge in deuterium and in some inert gases. The experimental data confirm the theory of inertia of constricted plasma postulated by M. A. Leontovich and S. M. Osovets (Atomnaya Energiya 1, 81(1956)). (tr-auth)

7909

THE ELECTRON TEMPERATURE AND DEGREE OF IONIZATION IN THE FIRST STAGE OF A POWERFUL PULSED DISCHARGE. V. I. Kogan. Atomnaya Energiya 4, 178-80(1958). (In Russian)

Formulas for the electron temperature and degree of ionization in the first stage of a powerful pulsed discharge in hydrogen, based on the assumption of the predominance of the electron mechanism in ionization, were evaluated. (R.V.J.)

7910

ESTIMATION OF THE ELECTRON TEMPERATURE AND DEGREE OF IONIZATION IN THE FIRST STAGE OF A POWERFUL PULSED DISCHARGE. N. A. Borzunov, V. I. Kogan, and D. V. Orlinskii. Atomnaya Energiya 4, 180-3 (1958). (In Russian)

Measurements were made of the emission of the powerful pulsed discharge in hydrogen and of the visible portion of the spectrum. The data are analyzed on the basis of the assumption of the predominance of the electron mechanism in ionization. (R.V.J.)

7911

PLASMA PHYSICS IN THERMONUCLEAR FUSION PROCESSES. E. Canobbio and R. Croci. Energia nucleare (Milan) 5, 157-64(1958) Mar. (In Italian)

This paper outlines the most remarkable phenomena due to intense discharges in gases; the recent results, obtained in the Harwell, Aldermaston, and Los Alamos laboratories, are examined in connection with such phenomena. The problems are also considered which will arise during these phenomena interpretation. (auth)

7912

DETERMINATION OF THE EQUILIBRIUM TEMPERATURE OF A PLASMA. Philip J. Dickerman (Univ. of Chicago). J. Appl. Phys. 29, 598(1958) Mar.

Spectroscopic temperature determinations have been made on a thermal plasma generated by a fluid-stabilized arc. The electrodes of the arc were a rod anode and a plate cathode with the electrically neutral plasma being discharged through an orifice in the cathode. The arc was confined by means of a rotating water column, thus increasing the current density and hence the plasma temperature. Temperature values were obtained by analysis of the Balmer series in hydrogen. The Holtsmark theory of Stark effect broadening by an electric field in conjunction with the Saha equations was employed as a method of measuring ion concentration and finally the temperature in the discharge plasma. (A.C.)

7913

A VARIATIONAL CALCULATION OF THE EQUILIBRIUM PROPERTIES OF A CLASSICAL PLASMA. S. F. Edwards (Univ. of Birmingham, Eng.). Phil. Mag. (8) 3, 119-24 (1958) Feb.

A variational calculation is given for the free energy of a fully ionized classical plasma. The method avoids redundant variables and allows for cross terms between collective and individual modes of oscillation, though these turn out to be small. A relation is given for the shielding distance in terms of the Debye-Hückel radius and the interparticle distance, it being of the order of the former. (auth)

7914

CORRELATIONS IN THE CHARGE DENSITY OF A CLASSICAL PLASMA. S. F. Edwards (Univ. of Birmingham, Eng.). Phil. Mag. (8) 3, 302-6(1958) Mar.

The charge density of a plasma can be described by the coefficients of its Fourier decomposition. The time correlation of these is calculated in this paper for arbitrary wavelength. The form of the correlation function then varies from that expected from wave motion at long wavelengths, to random perfect gas motion at short wavelengths, and bridges the gap between random short range motion and ordered long range effect. (auth)

Electrons

7915

STABILITY OF AN ELECTRON BEAM ON A SLALOM ORBIT. J. S. Cook, W. H. Louisell, and W. H. Yocom (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. 29, 583-7(1958) Mar.

A study is made of an electrostatic method of focusing an electron beam in a traveling wave tube in which the beam traverses a slalom-like orbit between the wires of the slow wave structure. The requisite field is produced by a row of equally spaced wires at the same potential placed midway between two parallel plates at another potential. The equations of motion are solved to find initial conditions for stable orbits. Space charge effects are considered. A large slalom tester was built to compare experimental and theoretical results. The agreement between the computed and measured current transmitted is surprisingly close. There is also good agreement between the measured and computed beam perveance. (auth)

7916

THE CIRCULAR POLARIZATION OF INTERNAL AND EXTERNAL BREMSSTRAHLUNG. H. Schopper and S. Galster (Univ. of Erlangen, Germany). Nuclear Phys. 6, 125-31 (1958) Mar. (2).

The circular polarization of internal and external bremsstrahlung was measured as a function of photon energy for the decay of $Sr^{90} + Y^{90}$. The experimental results are in general agreement with theoretical predictions assuming maximum violation of parity and ST or VA interaction. (auth)

7917

THEORY OF THE MULTIPLE SCATTERING OF POLARIZED ELECTRONS. B. Muhlschlegel and H. Koppe (Univ. of Heidelberg, Germany). Z. Physik 150, 474-96(1958). (In German)

A theory of the multiple scattering of polarized Fermi particles by isotropic scattering centers was developed and was applied to electrons by means of the small-angle approximation. The variation of the polarization in the scattering by a film and the self-depolarization of a radioactive compound can be calculated. (tr-auth)

Gases

7918 AECU-3665

California. Univ., Berkeley. Inst. of Engineering Research.

EVALUATION OF THE DIFFUSION EQUATION AND TABULATION OF EXPERIMENTAL GASEOUS DIFFUSION CONSTANTS. J. W. Eerkens and L. M. Grossman. Dec. 5, 1957. 31p. Project 35. Contract AT(11-1)-34. (HE-150-150). $6.30(ph OTS); $3.00(mf OTS).

An expression for the diffusion flux for a binary mixture (in the absence of external forces) was derived from the conservation laws and the principles of irreversible thermodynamics. The results are found to be in exact agreement with Chapman & Cowling's derivation. Secondly, a tabulation was made of experimental diffusion constants from the literature, and expressions for D_{12} and α_{12} from the general theory. (auth)

7919

ELECTRON IONIZATION CROSS SECTIONS USING CHOPPED BEAMS. R. L. F. Boyd and G. W. Green (Univ. Coll., London). Proc. Phys. Soc. (London) 71, 351-6(1958) Mar.

The paper describes the development of a crossed-beam method suitable for measuring ionization cross sections of unstable gases such as atomic hydrogen. Results obtained in He and H_2 are compared with those of Tate and Smith. The method makes use of a narrow band amplifier associated with a beam chopper and phase sensitive detector, to eliminate the current due to ionization of the background gas. The electric field in the collision region is such that limitation of the beam crossover volume can make the uncertainty in electron energy much smaller than is otherwise possible, without resorting to magnetic collimation or pulsed collection. An analysis of the sources of error due to the collection of spurious currents at signal frequency is given. (auth)

Instruments

7920 HW-53956

[General Electric Co. Hanford Atomic Products Operation, Richland, Wash.]

A STATIC SWITCHING INTERLOCK BETWEEN RADIATION AND PRESSURE MONITORING INSTRUMENTS. A. A. Maupin, Jr. Mar. 4, 1958. 30p. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

This document describes the detailed design procedure and construction method of a Cypak static switching interlock between Beckman flux monitors and the Panellit pressure gage. The control determines the sensitivity of each of the four flux monitors by sensing the settings of both input resistor and feedback voltage selector switches. Also, the positions of the Beckman bypass switches are monitored, as well as whether or not the internal circuitry of the Panellit is made up. An output signal is provided when any two or more flux monitors are not bypassed and are sensitive to current of 1×10^{-9} ampere or less. Another output signal, intended for annunciator purposes, is provided when any two (but only two) flux monitors are not bypassed and are sensitive to current of 1×10^{-9} ampere or less, provided the Panellit internal circuitry is not made up. Two unusual features of the control are its ability to detect its own internal failure and sound an alarm, and a readout switch with trouble location circuit which enables personnel to quickly locate the source of trouble. (auth)

7921 NBS-C-585

National Bureau of Standards, Washington, D. C.

THE MEASUREMENT OF THICKNESS. George Keinath. Jan. 20, 1958. 83p. $0.50(GPO).

The numerous methods for the measurement of thickness in laboratory or shop are treated in seven groups according to physical operating principles: Mechanical—weight/dimension relationships, acoustics, vibration, displacement with various conversions; chemical—stripping, spectrochemical analysis; electrical—dielectric breakdown, resistance, electrochemical, capacitance, thermoelectricity; magnetic—attractive force, reluctance, saturation, inductance, eddy currents; optical—microscopy (also electron microscopy), interferometry, diffraction, shadow; X-ray—absorption, diffraction, backscatter, spectrometry; radioactive radiation—absorption, backscatter, tracers. Ranges, accuracies, advantages, and limitations are discussed. A bibliography of references, a limited list of suppliers, and a detailed index of the gages, methods, applications, and trade names covered are appended. (auth)

7922 NP-6644

Fairchild Camera and Instrument Corp. Reconnaissance Systems Div., Syosset, N. Y.

REACTOR CONTROL INSTRUMENTATION—TRANSISTORIZED. [1957?]. 22p.

Through the use of transistors, reliable equipment operating life of 40,000 hours may be achieved. The specific equipment described was developed for use in a naval reactor system where reliability under extremes of environmental conditions is of primary importance. Used as an integrated system, this instrumentation provides complete monitoring of the neutron level of any large power reactor. Alternatively, individual components may be used to fit specific requirements of smaller power and research reactors. Topics discussed are: a general description of instrumentation, a description of source range equipment, intermediate range equipment, power range equipment, assembly description, and remote control. (M.H.R.)

7923 RIB-32

DuMont (Allen B.) Labs., Inc. Tube Operations Div., Passaic, N. J.

DEVELOPMENT OF PHOTOMULTIPLIER TUBES. Report No. 27 [for] August 1, 1957 to November 1, 1957. F. W. Schenkel, P. A. Snell, J. Bolakas, and J. Bramley. 25p. Contract AT(30-1)-1336.

(For preceding period see RIB-30.)

7924 SCTM-50-58(14)

Sandia Corp., Albuquerque, N. Mex.

RESISTANCE EFFECTS ON FREQUENCY FOR PULSED AND CONTINUOUSLY EXCITED RLC CIRCUITS. R. M.

McGehee. Mar. 5, 1958. 6p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

Pulsed RLC tank circuits are used in applications for which the frequency or the period of oscillation must be known accurately. This memorandum gives a method of determining the frequency deviations of pulse-excited circuits, caused by changes in circuit resistance, from measurements using continuous excitation. (auth)

7925 WAPD-T-345

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MAGNETIC AMPLIFIERS FOR REPLACEMENT OF RELAYS. R. W. Roberts, R. J. Radus, O. R. Rieley, and C. V. Fields. Sept. 1956. Changed from OFFICIAL USE ONLY Jan. 2, 1958. 31p. $4.80(ph OTS); $2.70(mf OTS).

When using conventional full-wave, self-saturating magnetic amplifiers, real savings in required apparatus can be realized by adding algebraically various control and feedback signals on one or more control windings. For this type of magnetic amplifier application, the amplifier performance is much less critical than that required of analog-type devices such as servo-amplifiers. The adaptation of magnetic amplifiers to encompass the performance of information-processing functions commensurate with the requisite power outputs is discussed. Several applications are described to illustrate the technique. (W.D.M.)

7926

MEASUREMENT OF MAGNETIC FIELDS BY MEANS OF NUCLEAR RESONANCE. A. Valeriu, I. Pascaru, and B. Ianculovici. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 235-9(1957). (In Romanian)

A detailed description is given of a magnetometer which determines the stability of magnetic fields by measurement of nuclear resonance. (J.S.R.)

7927

GRAPHICAL TREATMENT OF A COINCIDENCE CIRCUIT. Stanko Turk (Inst. »Ruder Boskovic«, Zagreb). Glasnik Mat. Fiz. i Astron. 12, No. 3, 219-22(1957).

To obtain the optimum performance of a circuit, the elements of the circuit are evaluated and the operating points and the output voltage determined in case of coincidence and when there is no coincidence. Since the circuit elements are nonlinear, a graphical method is used. (W.D.M.)

7928

AN AUTOMATIC PHOTOMETER. R. Senaux (Centre d'Études Nucléaires de Saclay, France). Ingrs. Techniciens 30, 4p(1957). (In French)

A description is given of a photometer designed to scan and classify nuclear emulsions automatically. (J.S.R.)

7929

PULSE GENERATOR BASED ON HIGH SHOCK DEMAGNETIZATION OF FERROMAGNETIC MATERIAL. R. W. Kulterman, F. W. Neilson, and W. B. Benedick (Sandia Corp., Albuquerque, N. Mex.). J. Appl. Phys. 29, 500-1 (1958) Mar.

The shock wave from a pellet of high explosive is passed without attenuation through one leg of a closed ferromagnetic core which has been previously magnetized. The shock wave demagnetizes the core, reducing the flux from the remanent value to zero. This change in flux generates a voltage in any winding wound on the core. Idealized calculations indicate that the voltage pulse generated in this manner will be a square wave with amplitude, in volts, given by $e_g = NB_R vw$, and a pulse width, in seconds, given by $T = s/v$, where N is the number of turns, B_R the remanent magnetization (webers/m^2) and v is the shock velocity (m/sec). It is also assumed that the core has a rectangular cross section, w being the width of the core (m) in the direction perpendicular to B_R and v, and s being the thickness of the core (m) in the direction parallel to v. Experimental tests have produced output pulses with an amplitude of 6400 v/turn-meter of w where the length of the pulse was in fair agreement with the known shock velocity of the material used. At the present time it is believed that the operation of the device can be explained by a transducer mechanism which converts some of the energy of the shock wave into electrical energy. (auth)

7930

ELECTRONIC SIMULATOR FOR THE STUDY OF RADIOACTIVE PHENOMENA. Monique Gutmann and Robert Comte. J. phys. radium 18, Suppl. 12, 158A-62A(1957) Dec. (In French)

The theory of an electronic simulator for the study of radioactive phenomena is presented. A schematic of the simulator is given. The apparatus gives a precision of 2% if it is properly calibrated. (J.S.R.)

7931

SYNCHRONIZED AUTODYNE DETECTOR AND ITS USE IN THE STABILIZATION OF MAGNETIC FIELDS WITH PROTON RESONANCE. W. Müller-Warmuth and P. Servoz-Gavin (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 13a, 194-203(1958) Mar. (In German)

For detection of nuclear magnetic resonance signals an autodyne detector with a singly coupled standard frequency was used. The methods of synchronized autodynes and modified Q meters, differentiated according to the standardization of the oscillators, have a good sensitivity and frequency stability which depends only on the synchronization frequency. Expressions on the character of nuclear resonance absorption were derived and discussed, on the basis of the van der Pol theory. These show the nonlinearity of the autodyne calculations which appear for the signal-to-noise ratio as proven and explicit in the formulas. Because of the simplicity and the possibility of modifying the frequency over wide range, the described method can be used for the stabilization of magnetic fields with proton resonance. The block wiring diagram of a stabilizer with a relative field stability of better than 10^{-6} was given. (tr-auth)

Isotopes

7932 AECU-3603

Michigan. Univ., Ann Arbor.
ENRICHMENT OF ISOTOPES BY THE DIFFERENCE IN RATES OF ISOTOPIC REACTIONS. Richard B. Bernstein. Apr. 15, 1957. 25p. Contract AT(11-1)-321. (M-6225). $4.80(ph OTS); $2.70(mf OTS).

The difference in rates of reaction of isotopic molecules may be utilized to produce appreciable isotope enrichments. When a competitive irreversible isotopic reaction is carried out to a high extent of completion, the residual unconverted substrate becomes exponentially enriched in the heavier isotope. In deuterium systems, a substantial function of the D inventory is retained in the enriched residual substrate, so that conversion of the depleted product is unnecessary. For isotopes of heavier elements such as C^{13}, N^{15}, and O^{18}, the retention is low, so that product conversion and recycling is desirable unless the starting material is of negligible value. Experiments are described in which enrichments of C^{13} have been obtained using the reaction rate principle in dehydration of formic acid and hydrolysis of urea. Procedures are given for the preparation of decimolar barium carbonate at the level of 1.6% C^{13}, and molar barium carbonate at the 1.4% level starting with commercial materials. (J.R.D.)

Isotope Separation

7933 SO-3261
Rensselaer Polytechnic Inst., Troy, N. Y.
PROGRESS REPORT ON RESEARCH ON ISOTOPE SEPARATION BY A DISTILLATION-DIFFUSION PROCESS. Paul Harteck and Gene Mannella. June 30, 1957. 11p. Contract AT(30-3)-52. $3.30(ph OTS); $2.40(mf OTS).

An investigation was carried out to study the feasibility of separating isotopes by a process of distillation-diffusion. The process consists of evaporating molecules of the binary mixture to be separated, diffusing them through a barrier gas of suitable mass, and condensing them at a cold surface. The condensate is delivered back to the evaporating surface, setting up a counterflow. (W.L.H.)

7934 SO-3262
Rensselaer Polytechnic Inst., Troy, N. Y.
SUMMARY REPORT ON RESEARCH ON ISOTOPE SEPARATION BY A DISTILLATION-DIFFUSION PROCESS. Paul Harteck and Gene Mannella. June 30, 1957. 73p. Contract AT(30-3)-52. $12.30(ph OTS); $4.50(mf OTS).

An investigation has been carried on to study the feasibility of separating isotopes by a process of distillation-diffusion. The process consists of evaporating molecules of the binary mixture to be separated, diffusing them through a barrier gas of suitable mass, and condensing them at a cold surface. The condensate is delivered back to the evaporating surface, setting up a counterflow. Using an all-glass system, isotopes were separated as part of an organic molecule with a stage efficiency of about 50%. In order to increase the effectiveness of the process, an all-metal apparatus with a rotating separation tube was constructed. The rotation of the tube negated the effects of surface tension and permitted the distance between the evaporating and condensing surfaces to be held to a minimum. This greatly increased the transport of isotopes. Nineteen runs were made using lithium as the binary mixture. The best separation factor obtained was 1.54. By constructing an apparatus which would rotate with a centrifugal force of about 100 g's, and using direct heating instead of radiation, it is believed the distillation-diffusion process can be used to separate isotopes of alkaline metals with a high efficiency. The process is a general one and requires no modification in equipment to be used as an ideal distillation, if desired. (auth)

7935 AEC-tr-3196
ISOTOPE CONCENTRATION IN ULTRACENTRIFUGES WITH HYDROGEN STABILIZATION. W. Groth and P. Harteck. Translated from Z. Elektrochem. 54, 129-32 (1950). 5p.

The enrichment of gaseous or vaporous isotopes of heavier elements with the aid of gas ultracentrifuges was studied. The enrichment was found to take place in (1) single chamber centrifuges under discontinuous operation with concentration of the gas supplied to the centrifuge rotor resulting in an increase of the degree of enrichment, or according to (2) a multiplication process which in continuous operation with parallel connection of two centrifuges makes it possible to multiply simultaneously the enrichment of the light and heavy isotopes. (auth)

7936
THE ELECTROMAGNETIC SEPARATION OF ISOTOPES. B. De Michelis. Energia nucleare (Milan) 5, 175-86(1958) Mar. (In Italian)

Isotope separation by electromagnetic methods is illustrated in this paper. A description is given of various types of current sources, extraction systems, aberration causes, spatial charge neutralization processes, ion flow fluctuation effect, and isotope receivers. The paper ends with a brief mention of the utilization and application of separated isotopes. (auth)

Mass Spectrography

7937
APPLICATION OF THORIA-IRIDIUM AS THE SOURCE OF IONIZING ELECTRONS IN MASS SPECTROMETRY. C. E. Melton (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 29, 250(1958) Mar.

In mass spectrometric studies of the photolysis of chlorine and formic acid to produce hydrogen chloride and carbon dioxide, a source pressure of 10^{-5} mm Hg is required; consequently, the principal instrumental difficulty encountered is burnout of the tungsten filament used to produce ionizing electrons. Due to the reaction of chlorine the filament must be replaced after each eight hours of service. The use of thoria-iridium as a filament in a mass spectrometer is discussed. This filament has a lower operating temperature, is chemically resistant to corrosive gases, has constant emission characteristics, and has a long life. (A.C.)

7938
RHENIUM AS AN ELECTRON EMITTER IN MASS SPECTROMETRY. Charles F. Robinson (Consolidated Electrodynamics Corp., Pasadena, Calif.) and A. G. Sharkey, Jr. (U. S. Bureau of Mines, Pittsburgh). Rev. Sci. Instr. 29, 250-1(1958) Mar.

7939
A MASS SPECTROMETER WITH COMPLETE DOUBLE FOCUSING OF THE SECOND ORDER. H. Hintenberger and L. A. König (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 13a, 236-7(1958) Mar. (In German)

Ten parameters were calculated and tabulated for 26 different mass spectrometers with complete double focusing of the second order. (J.S.R.)

Mathematics

7940 CF-54-9-245
[Oak Ridge National Lab., Tenn.]
STABILITY OF SOLUTIONS OF THE REACTOR EQUATIONS. John A. Nobel. Sept. 14, 1954. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The stability of the periodic solution with a known period for the nonlinear delay-differential equation for the power in a circulating fuel reactor is investigated. The difficulties in applying classical ideas of stability for ordinary differential equations to this case are indicated, along with an outline of the stability problem of the zero solution. (J.R.D.)

7941 LA-2150
Los Alamos Scientific Lab., N. Mex.
TABLES OF NONRELATIVISTIC COULOMB WAVE FUNCTIONS. Arnold Tubis. Aug. 1957. 277p. Contract W-7405-eng-36. $6.00(OTS).

Tables of the nonrelativistic Coulomb functions, $F_0(\eta,\rho)$ and $G_0(\eta,\rho)$, and their derivatives $(d/d\rho)/F_0(\eta,\rho)$ and $(d/d\rho)/G_0(\eta,\rho)$ are tabulated to five significant digits for the ranges $0 \leq \rho \leq 40$ and $0 \leq \eta \leq 12$ with interval spacings $\Delta\rho = 0.2$ and $\Delta\eta = 0.05$. (auth)

Measuring Instruments and Techniques

7942 CF-8008
Gt. Brit. Dept. of Atomic Energy. Industrial Group H. Q., Risley, Lancs, England.

A PROPOSED METHOD FOR THE DETECTION, IDENTIFICATION AND MEASUREMENT OF LONG LIVED α-EMITTERS IN THE ATMOSPHERE BY α-PARTICLE ENERGY DISCRIMINATION. N. Winogradoff. [195?]. 23p.

7943 NAA-SR-Memo-618

North American Aviation, Inc., [Downey, Calif.].

SLOW NEUTRON ACTIVATION OF TEST SPECIMEN AND CAPSULE COMPONENTS TO BE USED AT THE NEVADA TEST SITE. J. C. Lang and B. L. Smith. Mar. 3, 1953. Decl. Mar. 25, 1958. 9p. $1.80(ph OTS); $1.80(mf OTS).

Samples were taken from a test capsule to be exposed to a nuclear bomb explosion and irradiated in the Water Boiler Neutron Source. The induced radioactivity was measured and extrapolated to predict the radiation levels to be encountered after the bomb test. Calculational methods and results are given. (D.E.B.)

7944 USNRDL-TR-202

Naval Radiological Defense Lab., San Francisco.

COLLIMATOR PENETRATION AND SCATTERING EFFECTS. R. A. Hefferlin and W. E. Kreger. Mar. 12, 1958. 30p.

The type of lead collimator usually used for gamma-ray spectrometers covering the energy range up to 1 Mev has been found essentially free from scattering; hence, the effective collimator aperture to gamma radiation in certain source-collimator geometries can be calculated according to the theory of Mather. The same quantity for a combination of source collimator and detector collimator can likewise be calculated as if the combination were replaced by a continuous collimator of the same total length; providing the units are at least 4 and 6 in. long, respectively. (auth)

7945 WAPD-RM-206

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

BOOST OF IONIZATION CHAMBER PULSE BY CHAMBER SUBDIVISION OR TRANSFORMER. W. W. Ramage and R. H. Frazier. Dec. 1953. Changed from OFFICIAL USE ONLY Jan. 10, 1958. 35p. Contract AT-11-1-GEN-14. $6.30(ph OTS); $3.00(mf OTS).

The pulse voltage delivered to the first stage of a pulse amplifier may be boosted either by insertion of a transformer between the chamber and the amplifier, or by subdividing the chamber into sections which are placed in series. For a chamber of a certain total plate area, subdivision into n equal parts connected in series theoretically gives the same pulse boost as the use of an ideal transformer with a step-up ratio of a = n. In either case, if the undivided chamber capacitance is large compared to the input capacitance of the amplifier, the theoretical maximum boost or gain achievable is one-half of the square root of the ratio of the chamber capacitance to amplifier input capacitance. For the subdivided chamber or the ideal transformer, the action is independent of the shape of the pulse. However, for a non-ideal transformer the pulse delivered to the amplifier is not a faithful magnification of the pulse generated in the chamber, and unless precautions are taken oscillations produced in the circuit may give spurious pulses or counts. Whereas these schemes can boost the pulse delivered to the amplifier, they also influence the noise output of the amplifier. (auth)

7946

A METHOD FOR DETERMINING THE MASS AND ENERGY OF IONIZING PARTICLES WITH THE AID OF NUCLEAR EMULSIONS. M. Petrascu and C. Besliu (Univ. of Bucharest). Acad. rep. populare Romîne Rev. Phys. 11, 55-8 (1957). (In French)

A method applicable to tracks of non-relativistic particles whether the tracks terminate in the emulsion or not was derived. The method depends on a relationship between the mass of the unknown particle and the grain density of its path in the emulsion. The mass can be determined within an error of 10%. (J.S.R.)

7947

A C^{14} DATING STATION USING THE CO_2 PROPORTIONAL COUNTING METHOD. Ingrid Olsson (Inst. of Physics, Uppsala). Arkiv Fysik 13, 37-60(1958).

A comparison is made between previous results and methods of solid carbon inside Geiger counters, gaseous samples in Geiger and proportional counters, and scintillation counters for determining C^{14} activity. The Uppsala dating station is described and specifications on the counter, shielding, and electronics are given. The process by which the samples are purified and put into the proportional counter in the form of CO_2 gas is described in detail. The background count has been cut to 0.98 counts per minute due to the improved shielding. (W.D.M.)

7948

DOSIMETER DEVICES. Atomnaya Energiya 3, No. 10, 367(1957).

The x-ray dosimeter measuring within a region of from 10 to 10,000 r is described. The electrofilter is destined for measurements of α- and β-active aerosol concentration. About 85 to 90% of all aerosols of various dispersions are concentrated with a sucking-through out-put per liter of 1600 l/min. The device JLK -3 permits measuring of γ and thermal neutron doses within the region of from 0.02 to 1,000 r. For the determination of blood circulation velocity and activity accumulation in the thyroid gland the clinical radiometer Na^{24} is used. The pocket radiometer permits measuring of γ radiation within the region of 0.1 to 100 mc/sec and β radiation within the region of from 5 to 500 β particles/cm^2 sec. (TCO)

7949

THE USE OF NUCLEAR EMULSIONS TO DETERMINE THE RADIOCHEMICAL PURITY OF α-EMITTERS. V. I. Baranov, K. B. Zaborenko, and V. I. Korobkov. Atomnaya Energiya 4, 199-202(1958). (In Russian)

7950

POCKET β AND γ RADIOMETER. V. V. Markelov, A. M. Lushikhin, and V. I. Nikiforov. Atomnaya Energiya 4, 217-18(1958). (In Russian)

A pocket β and γ rate meter was designed by the Academy of Medical Sciences of U.S.S.R. for detecting gamma radiation of 0.25 to 2 Mev and for β particles of 0 to 50 and 0 to 500 particles/cm^2/sec, with energies of 0.5 to 2 Mev. Measurements of β particles are made through the back wall opening in the apparatus. The opening is closed during the recording of γ radiation, which permits differentiation between the β and γ radiation. The accuracy of the counter is within ±15%. (R.V.J.)

7951

UNIVERSAL SCINTILLATION DOSIMETER. I. B. Keirim-Markus, V. V. Markelov, V. I. Nikiforov, and L. N. Uspenskii. Atomnaya Energiya 4, 218-19(1958). (In Russian)

7952

LOW LEVEL LOW ENERGY LOW QUANTITY SAMPLE COUNTING IN TRACER WORK. Fazle Hosain (Inst. of Nuclear Physics, Calcutta). Naturwissenschaften 45, 107 (1958).

A gas-flow Geiger counter has been set in anticoincidence with a ring of 10 Geiger-Mueller cosmic-ray counters and the whole assembly placed inside an iron

castle. Radioactive samples can be introduced directly within the structure of the counter. The apparatus has been used in very low level tracer work with S^{35}, Fe^{55}, and I^{131}. (J.S.R.)

7953

A NEW MEASUREMENT TECHNIQUE FOR USE IN THE REGION OF THE BLOB-DENSITY MAXIMUM IN NUCLEAR EMULSIONS. B. J. O'Brien (Univ. of Sydney). Nuovo cimento (10) 7, 314-19(1958) Feb.

The blob density (N_b) is insensitive to changes in ionization in the region of its maximum value. However the density (N_s) of isolated grains, has been found to be useful in this region, and thus the combined techniques of measuring N_b and N_s provide a simple and rapid method of track measurement over the complete range of ionization. An approximate theoretical expression for the variation of N_s with the probability of development is presented. This expression is tested by measurements on tracks of relativistic cosmic rays over a wide range of charge, and an application of the technique to cosmic-ray studies described. The variation of N_s with the residual range of protons in two emulsions with plateau grain densities of 8 and 20 grains per 100 μm is compared with the corresponding variation of N_b. Possible sources of error in measured values of N_s are found to be similar to those of N_b. (auth)

7954

A CIRCULAR POLARIMETER FOR LOW ENERGY γ-RAYS. M. Bernardini, P. Brovetto, S. Debenedetti, and S. Ferroni (Univ. of Turin). Nuovo cimento (10) 7, 416-18 (1958) Feb. 1.

A gamma circular polarimeter has been built based on Compton back-scattering from iron magnetized parallel and antiparallel to the incident radiation. The design has two advantages over previous polarimeters; it makes use of the maximum percentage difference for the two directions of polarization, and can be employed at relatively low energies. A toroidal radioactive source is located on one of the pole pieces of a magnet, and the gamma rays are back-scattered from the other pole piece. They are detected by a NaI scintillator situated in an axial hole in the first pole and shielded with Pb from the direct radiation of the source. (W.D.M.)

7955

NOTE ON THE TRACK DENSITY OF MINIMUM-IONIZING PARTICLES IN LARGE EMULSION STACKS. B. Bhowmik, J. H. Davies, D. Evans, and D. J. Prowse (Univ. of Bristol, Eng.). Nuovo cimento (10) 7, 712-14(1958) Mar. 1.

On the basis of recent experience, it is suggested that Ilford G-5 emulsion stacks should be refrigerated after exposure when they are to be shipped over large distances by public transport. (auth)

7956

TWO-DIMENSIONAL PULSE-HEIGHT ANALYZER. M. Birk, T. H. Braid, and R. W. Detenbeck (Princeton Univ., N. J.). Rev. Sci. Instr. 29, 203-9(1958) Mar.

A two-dimensional analyzer classifies a coincidence event between two detectors according to both pulse amplitudes. The events are sorted into "channels" covering a plane instead of the linear array of a conventional analyzer. For coincidence measurements in which the amplitude spectrum from one detector is examined as a function of the pulse height from the other over a wide range, such a device provides maximum efficiency in recording the data. An analyzer is described, in which each coincidence is recorded on a punched paper tape memory as a pair of correlated numbers (the two pulse heights) in binary notation (1–127). In the subsequent read-out these two numbers specify a two-dimensional channel. To examine the information in a particular region of the plane, a circuit controlled by a mechanical tape reader determines those events for which one coordinate lies in a preselected range. The corresponding coordinates are then displayed as a spectrum on a conventional 100-channel analyzer by a digital-to-analog conversion system in such a way that each event appears in the channel whose number is punched on the tape. The maximum recording rate is 8/sec; read-out is at 10/sec. The maximum number of channels is $(127)^2$. In experiments with low coincidence rates the time taken to record and analyze such data is very considerably less than by conventional methods. Examples are given of the application of the analyzer to a $(p,p'\gamma)$ experiment and to the identification of energetic charged particles by measuring simultaneously their energy and differential energy loss. (auth)

7957

CAPACITOR MICROPHONE AS A RADIATION DETECTOR. Mary L. Harbold and J. Lloyd Bohn (Temple Univ., Philadelphia). Rev. Sci. Instr. 29, 229-32(1958) Mar.

Part I describes how a capacitor microphone acts as the variable capacitance to modulate the frequency in the tank circuit of an FM transmitter. When "chopped" light falls on the capacitor microphone, the capacitance of the microphone fluctuates at the same frequency as the "chopping" frequency. In Part II is given an analysis of the action. This shows that absorption of the incident electromagnetic radiation sets up a temperature gradient across the thickness of the front electrode. As a result of this, the front of the electrode, the part facing the radiation source, expands toward the source. This causes a change in the distance between the electrodes of the capacitor and thus varies the capacitance of the microphone. The instrument, which responds to a wide range of frequencies and to a very large dynamic range of intensity, is quite rugged. It has an additional advantage in being its own telemetering device. (auth)

7958

IMPROVED QUENCHING CIRCUIT FOR GEIGER COUNTERS. A. D. Crowell and P. R. Low (Univ. of Vermont, Burlington). Rev. Sci. Instr. 29, 245-6(1958) Mar.

Various circuits are discussed for increasing counting rates and lifetime of self-quenching Geiger counters. A new circuit employing modern components and possessing the advantages of a multivibrator circuit without the drawbacks in the previous multivibrators has been developed. (A.C.)

7959

COSMOTRON EXTERNAL BEAM MONITOR. Carol Brand (Univ. of Rochester, N. Y. and Brookhaven National Lab., Upton, N. Y.) and Clifford Swartz (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 29, 247-8(1958) Mar.

A device of sufficiently low density so that it could be left in the beam for continuous monitoring by the Cosmotron operators is described. The device is an 8-in.-diam. ionization chamber with Mylar walls. One wall is coated with Al and the other has a silk-screened silver mosaic of 64 spots. In the control room 64 bulbs are arranged in an array corresponding in position and size to the 64 spots of the chamber. Each time the beam passes through the chamber the appropriate bulbs light in the control room. The device is useful in locating the beam as it emerges from the Cosmotron and in monitoring the pencil beam. (A.C.)

7960

USE OF ISOPROPYLBIPHENYL AS SOLVENT IN LIQUID SCINTILLATORS. Warren L. Buck and Robert K Swank (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 29, 252(1958) Mar.

A scintillating solution using isopropylbiphenyl as the solvent is discussed. The use of the solution increased counting efficiencies for gamma rays. (A.C.)

7961

EVALUATION OF THE ABSORPTION OF RÖNTGEN AND GAMMA RAYS (INTENDED FOR MEDIUMS OF THE ATOMIC NUMBER ZEFF 6 TO 16). Ernst Krokowski (Freien Universität, Berlin). Strahlentherapie 104, 442-9 (1957). (In German)

For the evaluation of the absorption of x rays and γ rays in biologic tissues, the coefficients of debilitation and absorption, the capacity of braking and deviating of electrons of the elements of the atomic numbers 6 to 16 were calculated. With the aid of a graph it is possible to evaluate the dose absorbed per r-unit. The author calls the attention to the peculiarities of dose measuring with ultrahard radiations. (auth)

7962

THE MEASUREMENT OF RADIO ISOTOPES. Denis Taylor. London, Methuen & Co., Ltd. and New York, John Wiley & Sons, Inc., 1957. 139p.

Fundamentals of radioactive decay are reviewed. Radioactivity measuring apparatus and counting systems are described. Topics discussed include counting statistics, source geometry and self-absorption, methods of measurement and correction factors, and health hazards and radiation monitors. (C.H.)

Mesons

7963 UCRL-3481

California. Univ., Berkeley. Radiation Lab.

THE DYNAMICS OF π-μ DECAY IN FLIGHT. M. Lynn Stevenson. July 25, 1956. 10p. Contract W-7405-eng-48. $0.50(OTS).

The dynamics of π-μ decay in flight are presented in graphical form for pion kinetic energies (T_π) from 5 Mev to 100 Mev. (auth)

7964

MULTIPLE MESON PRODUCTION IN MESON-NUCLEON INTERACTIONS. E. Friedländer. Akad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 379-81(1957). (In Romanian)

It is shown that in interactions between two different particles (for example, a π meson and a nucleon) a pronounced asymmetry appears in the energy and angular distribution of the generated mesons. (J.S.R.)

7965

PAIR FORMATION BY BOUND PARTICLES IN EXTERNAL FIELD. K. Eftimiu and M. E. Maier. Acad. rep. populare Romîne Rev. Phys. 11, 39-48(1957). (In Russian)

An investigation was made of the possibility of using effective cross sections of pair formation to interpret experimental data of pair formation of μ mesons by fast electrons. The pair formation of particles with half-integral spin and pair formation of bound particles with zero spin were considered. (J.S.R.)

7966

ELECTROMAGNETIC INTERACTIONS OF μ MESONS AT GREAT DEPTHS. L. Avan. Ann. phys. 3, 123-78(1958) Jan.-Feb. (In French)

A detailed analysis of three types of electromagnetic interactions of μ mesons underground are presented—creation of collision electrons, bremsstrahlung radiation, and the direct creation of positron-electron pairs. The experiments were done at different depths in the mines at Maysur-Orne, corresponding to 300, 580, and 1,280 mwe. The results indicate an augmentation of the proportion (N_e/N_μ, N_γ/N_μ) of the electromagnetic components underground. The augmentation is caused by bremsstrahlung radiation and the direct creation of pairs, while the creation of collision electrons displays a saturation effect beginning at 300 mwe. A progressive hardening of the energy spectrum of the electron component was observed for the same zenithal angle. The knowledge of the flux and spectrum of photons allowed an estimation of their contribution to the generation of stars with a neutral primary. The experimental effective cross sections conform to the quantum theory for a particle with spin $\frac{1}{2}$ and with normal magnetic moment, within the limits of statistical precision. The data given on the distribution laws of positron-electron pairs directly created by μ mesons give new support for the William-Weizsacker method. (tr-auth)

7967

THE ANGULAR CORRELATION BETWEEN ELECTRON PAIRS CREATED BY γ-RAYS FROM THE π^0-DECAY. Erik Karlson (Univ. of Lund). Arkiv Fysik 13, 1-26(1958).

The possibility of a direct determination of the intrinsic parity of the neutral π meson by means of a bubble chamber experiment is investigated. The cross section for pair production by both the photons from the decay of a neutral π meson is computed as a function of the angle ψ, defined in the following manner. Each positron-negatron pair defines a plane. ψ is the angle between the projections of these normals on a plane, perpendicular to the photon direction. The cross section has the form $d\sigma/d\psi = \alpha(1 \pm \beta^2 \cos 2\psi)$. The sign is + for a scalar, – for a pseudoscalar meson. The computation gives $\beta^2 = 0.0091$. The Born approximation is used, and the effect of screening is neglected. (auth)

7968

ELASTIC AND INELASTIC SCATTERING OF K^+-PARTICLES IN NUCLEAR EMULSIONS. K. Kristiansson (Univ. of Lund). Arkiv Fysik 13, 91-100(1958).

The frequency of elastic and inelastic K^+ particle scattering and the energy loss in inelastic scattering have been studied at a K particle energy of 80 to 120 Mev. 32.5 m K particle track has been followed. The frequency of elastic scatterings in the angular interval 12 to 20° indicates a repulsive nuclear potential of about 10 Mev if the optical nuclear model is used. The mean free path for inelastic scattering (including charge exchange events) is equal to 1.12 ± 0.23 m, corresponding to a total cross section of 181 ± 37 mb. One $K^+ + P$ collision has been found. The scattering angle for the K^+ particle is 57° in the center-of-mass system. (auth)

7969

DEPENDENCE OF μ-MESON AND ELECTRON POLARIZATION ON CORRELATION PARAMETERS IN $K_{\mu 3}$ AND K_{e3} DECAYS. J. Werle (Inst. for Nuclear Research, Warsaw). Nuclear Phys. 6, 1-9(1958) Mar. (2).

The polarization of the μ mesons and electrons emitted in $K_{\mu 3}$ and K_{e3} decays is investigated on the basis of the two-component theory of the neutrino field. A quite general form of the transition matrix is used under the only assumption that the corresponding K mesons have no spin. It is shown that for pure couplings the form of the functional dependence of the polarization vector on the correlation parameters E and θ is uniquely determined by the type of coupling and does not involve the unknown coupling factors $C_i(E, \theta)$. A combined correlation and polarization experiment can, therefore, provide the best tool for the investigation of the actual form of the coupling responsible for the $K_{\mu 3}$ and K_{e3} decays. (auth)

7970

SPINS AND PARITIES OF THE $_\Lambda H^4$ HYPERFRAGMENT AND K-MESON. Chou Kuang-Chao and M. I. Shirokov

(Joint Inst. of Nuclear Research, Lab. of Theoretical Physics, Dubna, USSR). Nuclear Phys. 6, 10-19(1958) Mar. (2).

If K mesons, hyperfragments, or hyperons are created in the $\pi^- + He^4$ reaction near the threshold or in the $K^- + He^4$ reaction at low K^--particle energies (but without mesic atom formation), the spins of these unstable particles (and in some cases their parities) can be determined from the correlations between the directions of the momenta of the particles involved in these reactions and the directions of emission of decay products of the unstable particles. Qualitative changes in the correlation formulas for the cascade $K^- + He^4 \rightarrow {}_\Lambda H^4 + \pi^0$, ${}_\Lambda H^4 \rightarrow He^4 + \pi^-$ are indicated which arise if one rejects the assumption that the K-meson spin is zero. The helium experiments together with the previously suggested hydrogen experiments (e.g., $\pi^- + p \rightarrow \Sigma + K$ or $K^- + p \rightarrow \Sigma + \pi$) are the only ones which are of practical use for the determination of new particle spins from angular correlations. (auth)

7971

DECAY INTERACTION OF THE PI-MESON. S. Kamefuchi (Univ. of Copenhagen) and S. Oneda (Univ. of Manchester, Eng.). Nuclear Phys. 6, 114-24(1958) Mar. (2).

It is pointed out that the question of the elementarity of the decay interaction of the π meson could be settled by considering its radiative decay. For this purpose, the energy spectrum and the angular correlation function of daughter particles are calculated without using any approximation for strong interactions. These functions also serve to determine the concrete form of the decay interaction. (auth)

7972

DERIVATION OF THE $\Lambda^0-\alpha$ POTENTIAL FROM THE ${}^5He_\Lambda$ AND ${}^9Be_\Lambda$ HYPERFRAGMENT BINDING ENERGIES. H. Wilhelmsson (NORDITA, Copenhagen) and P. Zielinski (Instytut Badan Jadrowych Polskiej Akademii Nauk, Warsaw). Nuclear Phys. 6, 219-21(1958) Mar. (3).

7973

POLARIZATION OF THE RECOIL NUCLEUS IN μ^--CAPTURE. Thomas Fulton (Johns Hopkins Univ., Baltimore). Nuclear Phys. 6, 319-22(1958) Mar. (3).

The complete expression is calculated for the allowed, non-relativistic transition rate of μ^- capture from the atomic K shell. It is used to obtain the expression for the polarization of the recoil nucleus. The polarization term governs the asymmetry in the subsequent beta decay. If the incident μ are unpolarized, the polarization of the recoil following μ capture in a Gamow-Teller transition can in principle distinguish between the coupling constants suggested by Lee and Yang and by Feynman and Gell-Mann. (auth)

7974

ON THE DECAY INTERACTIONS OF NEUTRAL K_{e3} AND $K_{\mu 3}$. S. Furuichi (Hiroshima Univ.). Nuovo cimento (10) 7, 269-77(1958) Feb. 1.

The decay interactions of the processes $K^0 \rightarrow e + \nu + \pi^c$ and $K^0 \rightarrow \mu + \nu + \pi^c$ are investigated. Under the assumption that these processes occur through the weak Fermi interaction the analysis has been performed about the energy spectra and angular correlations of charged secondaries in order to obtain some information about the decay interactions. (auth)

7975

SOME REMARKS ON PARITY NON-CONSERVATION AND THE $\tau-\theta$ DILEMMA. S. Gotô (Tokyo Gakugei Univ.). Nuovo cimento (10) 7, 278-89(1958) Feb. 1.

Lee and Yang have succeeded in ascribing the parity non-conservation in the weak interactions to the singular nature of the mass zero neutrino, a screwon theory of two component neutrino. In this paper are introduced two kinds of neutrinos, the right circularly polarized neutrino and the left circularly polarized neutrino in the normal particle state, in order to forbid the unwanted processes such as $\mu^+ \rightarrow e^+ + e^+ + e^-$ and $\mu^- + p \rightarrow p + e^-$ which are not forbidden in the Lee-Yang's original formulation, and discuss a possibility of solving the so-called $\tau-\theta$ dilemma by virtue of the virtual neutrino's effect. (auth)

7976

THE STIMULATED DECAY OF THE LAMBDA HYPERON-I. F. Ferrari and L. Fonda (Univ. of Padua and Univ. of Trieste, Italy). Nuovo cimento (10) 7, 320-7(1958) Feb. 1.

In order to interpret a recent experimental result regarding the stimulated decay of Λ-hyperons bound in hyperfragments, a model has been considered in which the decay of the Λ-hyperon may also occur when in the virtual Σ-state. The consequences of the non-conservation of parity are also considered. (auth)

7977

STIMULATED DECAY OF THE Λ HYPERON IN LIGHT HYPERFRAGMENTS. M. Baldo-Ceolin, C. Dilworth, W. F. Fry, W. D. B. Greening, H. Huzita, S. Limentani, and A. E. Sichirollo (Istituto Nazionale de Fisica Nucleare, Milan and Univ. of Padua). Nuovo cimento (10) 7, 328-37 (1958) Feb. 1.

From a group of double stars which were produced by 4.5 Bev negative pions, a selection has been made of those events with linking tracks longer than 20 μm and which appeared to represent the non-mesonic decays, mainly, of ${}_\Lambda He$, ${}_\Lambda Li$, and ${}_\Lambda Be$ hyperfragments. A total of 31 hyperfragments satisfied these criteria. From a study of the energy distribution of the charged particles from these disintegrations, it has been found possible to separate the decays into those where the hyperon was stimulated into decaying by a neutron, from those caused by a proton. The ratio of neutron to proton stimulation is found to be about 1.4. This value may give some indications about the parity of the Λ hyperon and the possible transition $\Lambda \rightarrow \Sigma + \pi$. (auth)

7978

"COMPOSITE" MODEL FOR K-MESONS. S. N. Biswas (Univ. of Adelaide, South Australia). Nuovo cimento (10) 7, 577-600(1958) Mar. 1.

It is proposed that the heavy mesons are composite and are excited bound states of two pions. The interaction between the two pions is assumed to be due to a pseudoscalar field with direct coupling. To predict the K mesons the interaction strength, g^2, is found to be equal to, or rather greater than, 1.789 $\pi(\mu/m)$. The usual procedure of the renormalization of the pseudoscalar and scalar theories has been used to obtain the covariant wave equation describing the two-boson bound system. The complete and separable solutions of the wave equation predict the existence of a new quantum number whose properties are similar to those of the "dionic" number or the "strangeness" number proposed by other authors. The decay of the K mesons has been studied on the basis of a universal Fermi interaction. The life time turns out to be $\approx 10^{-7}$ s, in reasonable agreement with the observed time. The associated production of the strange particles has been explained with the help of Feynman diagrams on the assumption of conservation of the new relativistic quantum number. (auth)

7979

ANGULAR CORRELATION FOR PRODUCTION AND DECAY OF Λ^0. D. Bartolucci (Univ. of Bologna) and V. De Sabbata (Istituto di Fisica dell'Universita, Parma and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 7, 661-76(1958) Mar. 1.

The angular correlation function for production and decay of the Λ^0 particles is obtained assuming spin $S = 1/2$ for the Λ^0 and zero spin for the θ^0. Parity conservation and parity non-conservation in decay are discussed under the alternative hypothesis of either a definite parity for the Λ^0-θ^0 system or of parity doublets. Parity non-conservation in decay leads to anisotropy with respect to the direction perpendicular to the plane of production. This anisotropy does not appear if parity is conserved. In either case the existence of parity doublets shows an anisotropic distribution in the plane of production, which involves odd powers of cos ϑ (ϑ being the angle between the outgoing π^- and the Λ^0). If no parity doublets are assumed in production the angular distribution for the decay angle ϑ is in even powers of cos ϑ. Since the highest powers of cos ϑ are determined by the value of the spin S of the Λ^0 particle, the angular distribution for decay can be indicative for the value S. Comparison is made with the experimental curves obtained in Bologna. (auth)

7980

ON THE SPIN OF THE MUON. L. M. Brown (Northwestern Univ., Evanston, Ill.) and V. L. Telegdi (Univ. of Chicago). Nuovo cimento (10) 7, 698-705(1958) Mar. 1.

The distribution in angle and energy of the electron arising from the decay of a longitudinally polarized muon of spin 3/2 is calculated, using the most general parity non-conserving direct interaction. The result depends upon three parameters (functions of the coupling constants) which cannot be adjusted to give agreement with experiment. (auth)

7981

DETERMINATION OF THE COUPLING CONSTANTS IN $\mu^- + p \rightarrow n + \nu$. L. Wolfenstein (CERN, Geneva). Nuovo cimento (10) 7, 706-11(1958) Mar. 1.

For the reaction $\mu^- + p \rightarrow n + \nu$ the results of possible experimental observations including the neutron polarization have been calculated on the basis of the two-component neutrino theory. In the non-relativistic approximation these observations overdetermine the coupling constants, but relativistic effects, which are included in the calculation, are quite important for certain values of the coupling constants. (auth)

7982

NOTE ON THE POLARIZATION OF THE MUON IN $K_{\mu 3}$. S. Furuichi, S. Sawada, and M. Yonezawa (Univ. of Hiroshima). Nuovo cimento (10) 7, 718-19(1958) Mar. 1.

7983

ABSORPTION OF NEGATIVE K-MESONS AND THE NEUTRON AND PROTON DISTRIBUTIONS IN HEAVY NUCLEI. P. B. Jones (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 3, 33-41(1958) Jan.

Negative K mesons captured by the heavy nuclei in nuclear emulsion form K mesic atoms. It is shown that absorption occurs in the nuclear surface and takes place when the K^- meson is in a 5g state. Observations on capture events producing a visible Σ^- hyperon, and on the ratio of π^+ to π^--mesons created can give information on the relative neutron and proton densities in the part of the nuclear surface where the total density is less than 10% of the density at the center of the nucleus. Experimental evidence suggests that in this region of the nucleus the density of neutrons is approximately equal to the density of protrons. (auth)

7984

THE INTERACTION RATES OF STOPPED NEGATIVE MUONS IN IRON AND COPPER. A. M. Hillas, W. B. Gilboy, and R. M. Tennent (Univ. of Leeds, Eng.). Phil. Mag. (8) 3, 109-18(1958) Feb.

An apparatus suitable for measuring the mean lifetimes of negatively charged muons brought to rest in targets of $Z < 30$ is described. Measurements made on iron and copper yield mean lifetimes of $(204 \pm 14) \times 10^{-9}$ sec and $(157 \pm 20) \times 10^{-9}$ sec, respectively. (auth)

7985

POLARIZATION EFFECTS IN Σ^- CAPTURE. A. Pais (Inst. for Advanced Study, Princeton, N. J.) and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 109, 1759-62 (1958) Mar. 1.

The interaction of very slow, or captured, polarized Σ^- hyperons with protons, $\Sigma^- + p \rightarrow \Lambda^0 + n$, may be used to yield information concerning the parity of Σ relative to Λ, the (Σ, Λ) parity. A qualitative distinction between even and odd parity depends on whether or not the polarization of the emergent Λ's varies with angle of emission. In order to determine the parity unambiguously it would furthermore be necessary to know whether the reaction proceeds from an initial S or P state. Aside from these questions, the polarization of the emergent Λ's serves as a detector of the initial Σ polarization. For example, if Σ's produced under given circumstances do not show an appreciable up-down asymmetry in decay, the above reaction might help to decide whether this is due to negligible polarization of the Σ^- in production. (auth)

7986

K^--MESON CAPTURES BY BOUND NEUTRONS. Francis C. Gilbert and R. Stephen White (Univ. of California, Livermore). Phys. Rev. 109, 1770-8(1958) Mar. 1.

Experimental data are presented for K^--meson captures on bound neutrons and on two bound nucleons. K^--capture stars of only one prong and of only two prongs which are gray or black were analyzed in an effort to understand the basic neutron and 2 nucleon capture reactions. The same model that was used to explain the captures on bound protons has been extended to apply to bound neutrons. The average Σ-hyperon nuclear potential is determined to be 35 ± 10 Mev attractive. This potential, coupled with the previously determined Coulomb potential of 10 ± 3 Mev and the momentum of the capture nucleon, causes an estimated 78, 78, 60, and 55% of the Σ hyperons from the reactions $\Sigma^-\pi^+$, $\Sigma^-\pi^0$, $\Sigma^0\pi^-$, and $\Sigma^+\pi^-$, respectively, to be trapped in bound energy states. This high trapping probability leads to a high escape probability of 0.8 ± 0.1 for Σ hyperons in unbound states and a corresponding Σ^+- or Σ^--hyperon charge exchange cross section of 11_{-6}^{+7} millibarns per neutron or proton, respectively, in the Ag nucleus. The proton-to-neutron K^--capture ratio is found to be 4_{-2}^{+4}. The fraction of K^- captures on neutrons that leads to the reaction $\Lambda^0\pi^-$ is $0.00_{-0.00}^{+0.13}$. The results indicate that most of the K^- mesons are captured in the interior of the nucleus. The numbers of multinucleon K^- captures which occur by the reactions Σ^+n, Σ^-p, and Σ^-n are estimated to be $1.3_{-0.9}^{+2.2}$, $0.0_{-0.0}^{+1.5}$, and $0.4_{-0.4}^{+1.0}$%, respectively. The data of this experiment are consistent with the reaction rates of $2:1:1\frac{1}{4}:0:\frac{1}{2}:\frac{1}{2}:0$ for $\Sigma^-\pi^+$, $\Sigma^+\pi^-$, $\Sigma^0\pi^0$, $\Lambda^0\pi^0$, $\Sigma^-\pi^0$, $\Sigma^0\pi^-$, and $\Lambda^0\pi^-$, respectively. (auth)

7987

NUCLEAR INTERACTIONS OF HIGH-ENERGY μ MESONS IN CARBON. I. B. McDiarmid (National Research Council, Ottawa, Can.). Phys. Rev. 109, 1792-1800(1958) Mar. 1.

A multiplate cloud chamber containing two large plastic scintillators capable of selecting nuclear interaction is described. Forty-three interactions, attributed to energetic μ mesons, have been observed in the chamber and the following cross sections for interactions in carbon obtained: $(5.6 \pm 1.1) \times 10^{-30}$ cm^2/nucleon for all interactions involving energy transfers > 50 Mev and $(1.7 \pm 0.6) \times 10^{-30}$ cm^2/nucleon for shower production. It is shown that several

aspects of the interactions can be reasonably accounted for with the aid of the semiclassical Williams-Weizsäcker method and the results are used to infer photon interaction cross sections in carbon for photon energies up to about 10 Bev. The μ-meson cross sections reported here are in agreement with those found by George and Evans using emulsion techniques, but some of the details of the interactions differ and it is suggested that an appreciable fraction of the stars observed in an emulsion exposed underground may be due to π mesons or protons. (auth)

7988

SCATTERING OF MESONS BY MESONS. Juan de Oyarzabal (Instituto de Fisica de la Universidad Nacional de México e Instituto Nacional de la Investigación Cientifica). Rev. mex. fís. 1, 52-63(1952). (In Spanish)

The covariant formalism of Dyson is applied to the analysis of meson-meson scattering in the neutral pseudoscalar theory, taking into account the radiative corrections due to the interaction of the particles and their fields. Under these conditions, an explicit form of the fourth order term of the coupling constant of the S matrix element describing this process can be calculated. The mutual scattering of low energy mesons is studied as a special case. (tr-auth)

7989

TRANSFORMATION OF "SPIN DIRECTION" BY ORDINARY LORENTZ TRANSFORMATION. Giulio Ascoli (Univ. of Illinois, Urbana). Z. Physik 150, 407-8(1958).

A method is given for the transformation of spin direction by ordinary Lorentz transformations by the use of an intermediate frame in which the particle is at rest. The example of a π-μ decay in flight is considered. (J.S.R.)

Meteorology

7990 BNL-461

Brookhaven National Lab., Upton, N. Y.

ANALYSIS OF METEOROLOGICAL TOWER DATA, APRIL 1950–MARCH 1952, BROOKHAVEN NATIONAL LABORATORY. Irving A. Singer and Gilbert S. Raynor. June 1957. 96p. (AFCRC-TR-57-220; AD-133806). $2.75(OTS).

Meteorological data collected during two years at Brookhaven National Laboratory were analyzed by the Meteorology Group at the Laboratory under a contract with the Geophysics Research Directorate of the Air Force Cambridge Research Center. These data included mean hourly wind and temperature values from six levels of the 420-foot meteorology tower, hourly and six-hourly surface observations, and certain upper air data. The data were transferred to punch cards and analyzed by use of a computer. The results are presented in graphic form supplemented by the necessary written explanations and interpretations. To facilitate an understanding and a correct evaluation of the material presented, the physical features and the local climatology of the installation are described, the origin and accuracy of the data are given, and the analytical procedures are explained. These procedures included the use of one or more of the following classifications in each analysis: (1) standard time, (2) solar time, (3) solar season, (4) cloud index, (5) wind speed at several levels, and (6) gustiness. Since all the data available could not be completely analyzed, emphasis was placed upon a detailed analysis of the wind and temperature data from the six tower levels. The results were then related to various standard surface and upper air parameters, such as surface and geostrophic level wind speeds and cloud condition. The temperature analyses reported include: a study of the diurnal variation of temperature with height, a study of the diurnal range of temperature with height, and a study of the diurnal variation in lapse rate. Each of these variables was further related to cloudiness and solar season. The wind analyses reported include the following: a study of the diurnal variation of wind speed with height, a study of the diurnal variation in the wind profile, a study of the diurnal variation in n, a study of the frequency distribution of the wind classifications, a study of the relationship between geostrophic wind speeds and the change in speed with height over the tower height interval, and a study of the relationship between the surface wind speed and the change in speed with height over the tower height interval. Each of these variables was further related to cloudiness and wind gustiness. Other analyses relate lapse rate to wind speed, describe the wind and temperature structure during sea breeze hours, and investigate the wind and temperature relationships on completely clear and totally overcast days. A discussion on application of the data and recommendations for further analysis, and an appendix which contains a detailed description of the punch card layouts are included. (auth)

Molecular Properties

7991

MULTIPLICITIES OF THE UNIFORM PRECESSIONAL MODE IN FERRIMAGNETIC RESONANCE. I. H. Solt, Jr., R. L. White, and J. E. Mercereau (Hughes Research Labs., Culver City, Calif.). J. Appl. Phys. 29, 324-5(1958) Mar.

In order to interpret correctly the experimental results obtained from ferrimagnetic resonance experiments, it is necessary to understand completely the multiplicity of lines that can be observed. Most of these lines have been shown to be higher order precessional modes which are quite well understood. There still exists, however, some uncertainty connected with the uniform pressional mode. The uniform mode is of most importance since it is for this mode that values of line widths, g values, and anisotropy constants are usually quoted in the literature. It can be distinguished experimentally from the higher order modes since (a) its intensity of absorption is proportional to the uniform component of the rf magnetic field over the sample and (b) its intensity decreases much less rapidly with diminishing sphere size than for the higher order modes. We have observed, however, that there are several lines possessing these characteristics of the uniform mode. The relative intensities of these lines are strong functions of both temperature and frequency, they have different anisotropy constants, and their separation decreases with sphere radius. Data exhibiting these properties will be presented for experiments on spherical single crystals of MnZn ferrites performed in the microwave frequency range of 8000 to 12,000 Mc. A discussion of several possible mechanisms that might give rise to this phenomena is given. (auth)

Neutrons

7992 USNRDL-TR-201

Naval Radiological Defense Lab., San Francisco.

NEUTRON SPECTRA FROM MOCK FISSION SOURCES. E. Tochilin and R. V. Alves. Mar. 12, 1958. 17p.

The neutron energy spectrum from a commercial mock fission source was experimentally determined and compared with theoretical calculations. Various types of fission neutron spectra to be expected from reactors are discussed. (auth)

7993

POLARIZATION MEASUREMENTS ON D + D AND T + D NEUTRONS GENERATED BY LOW ENERGY DEUTERONS. P. J. Pasma (Rijksuniversiteit, Groningen, Netherlands). Nuclear Phys. 6, 141-50(1958) Mar. (3).

The polarization of D + D and T + D neutrons has been determined from the left-right asymmetry induced by elastic scattering through He^4. A gas scintillator with helium served as the scatterer. The scattered neutrons were detected in coincidence with the helium recoil nuclei. The D + D neutron polarization was found to increase from 6 % at 200 kev to about 9.5 % at 500 kev deuteron bombarding energy. Neutrons from the T + D reaction appeared to be nearly unpolarized for deuteron energies below 300 kev. (auth)

7994

TEMPERATURE DEPENDENCE OF THE DIFFUSION COEFFICIENT AND THE DIFFUSION LENGTH OF THERMAL NEUTRONS IN WATER. W. H. Dio and E. Schopper (Universitat Frankfurt/M.). Nuclear Phys. 6, 175-6(1958) Mar. (3).

Measurements of the diffusion coefficient and the mean life time of thermal neutrons were made in water at different temperatures, using a pulsed neutron source. (W.D.M.)

7995

OPTICAL MODEL CALCULATION OF THE INTERACTION OF SLOW NEUTRONS WITH PROLATE NUCLEI. V. V. Vladimirsky and I. L. Ilyina (USSR Academy of Sciences, Moscow). Nuclear Phys. 6, 295-304(1958) Mar.

The cross sections for absorption and scattering of slow neutrons by non-spherical ellipsoidal nuclei are calculated on the basis of the optical model. Diffuseness of the nuclear boundary and rotation of the nucleus are neglected. The results obtained allow us to explain the great width of the giant resonance in the region A = 150. It is shown that in the case of prolate nuclei the main resonances are accompanied by additional maxima. (auth)

7996

DIFFRACTION OF NEUTRONS BY IMPERFECT GASES. R. M. Mazo (Univ. of Chicago) and A. C. Zemach (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 109, 1564-72 (1958) Mar. 1.

The theory of cluster expansions is studied by a new method. A general procedure for obtaining the thermal average of a many-body function as a series in powers of density is derived. A recipe based on the Baker-Hausdorff theorem for reducing quantum thermal averages to their classical analogs is also described. These results are used to express the slow neutron cross sections of imperfect gases as power series in molecular density. Formulas are given for the leading contributions to both elastic and inelastic scattering. (auth)

7997

EMISSION OF SECONDARY NEUTRONS FROM NUCLEI BOMBARDED BY HIGH-ENERGY NEUTRONS. V. I. Gol'danskii, A. E. Ignatenko, A. I. Mukhin, V. S. Pen'kina, and V. A. Shkoda-Ulyanov (Academy of Sciences, Moscow). Phys. Rev. 109, 1762-9(1958) Mar. 1.

The mean number of secondary neutrons emitted in a single act of absorption of 120- and 380-Mev neutrons by Be, C, Al, Fe, Cu, Sn, and Pb nuclei has been determined for secondary neutron energies up to ~15 to 20 Mev; the neutrons are predominantly emitted as a result of evaporation which occurs after an intranuclear nucleon cascade. The mean number of secondary neutrons was found to increase monotonically from carbon ($\nu = 1-1.8$) to lead ($\nu = 6.6-9.9$) and was almost constant when the primary neutron energy was varied from 120 to 380 Mev. The experimental results are compared with those obtained by studying star formation in nuclear emulsions and also fission of heavy nuclei and the production of neutrons by cosmic rays. (auth)

Nuclear Physics

7998 BNL-462

Brookhaven National Lab., Upton, N. Y.

ANNUAL REPORT, JULY 1, 1957. 185p. $5.00(OTS).

The progress and trends of research are presented along with a description of operational, service, and administrative activities. Some scientific and technical details are given on research programs in the physical sciences, life sciences, and engineering, however, more complete technical information is available in quarterly progress reports, BNL technical reports, and scientific and technical periodicals. A bibliography of these publications is appended. (For preceding period see BNL-426.) (D.E.B.)

7999 NP-6650

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY PROGRESS REPORT FOR THE PERIOD JULY-SEPTEMBER 1957. Oct. 1, 1957. 35p.

A "phoswich" system applied so as to distinguish cosmic-ray effects from those of low-energy electrons incident on the front face of a scintillation detector is described. Targets of natural Sb and Sb^{121}(97.7%) were bombarded with α particles up to 5.6 Mev and pulse-height spectra are presented. The theoretical analysis of stability problems arising in connection with a high-energy proton accelerator using the pinch effect is carried out by considering a class of solutions of the Boltzmann equation. A search for K^--meson collisions on free H in nuclear emulsion was carried out in the energy region 0 to 82 Mev. The preliminary results are given from measurements of γ rays following the positron decay of Ga^{65}. An investigation was made of γ radiation induced formation of NH_3 in mixtures of N and H at gas pressures up to 100 atmospheres. A Co^{60} source of approximately 2500 wires, situated under 12 ft of H_2O for shielding purposes, was employed. (For preceding period see NP-6400.) (M.H.R.)

8000 ORNL-2430

Oak Ridge National Lab., Tenn.

PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 10, 1957. Apr. 8, 1958. 123p. Contract W-7405-eng-26. $3.25(OTS).

General specifications for a high-intensity proton synchrotron were worked out. High-energy injection is used to yield very high intensity at 12 Bev. A report is given on an investigation of the properties of the $\nu_r = 8/4$ nonlinear resonance, with special emphasis on its effectiveness in facilitating beam extraction from the proposed ORNL 900-Mev spiral-ridged cyclotron. Yields and angular distributions of gamma rays from coulomb excitation of states in Pt^{195} were measured. Direct excitation of levels in Pt^{195} is observed at 99, 130, 210, and 240 kev. The location of the second 2^+ state was established for ten even-even medium-weight nuclei by means of coulomb excitation produced by 8-, 9-, and 10-Mev alpha particles. Beta- and gamma-ray spectroscopy, utilizing both single and coincident NaI(Tl) crystals and a magnetic spectrometer, was carried out on the gamma and the electron radiations from Nb^{90}. The level structure of Zr^{90} was also determined. Angular distributions of the 3.09- and 3.68-Mev gamma rays resulting from the inelastic scattering of protons from C^{13} are given, as are distributions of the neutrons from the reaction

$C^{13}(p,n)N^{13}$. The (p,n) excitation functions for 12 intermediate nuclei were described by the use of a complex potential model for prediction of the formation of the compound nucleus and by the use of the statistical model of the compound nucleus for prediction of the decay. Absolute cross sections for (p,n) reactions in lithium and tritium were measured from threshold to 5 Mev. Parameters for low-energy resonance in Sm^{151} and Pm^{147} were determined from transmission measurements with the fast-chopper time-of-flight spectrometer. The angular distribution of neutrons scattered by the 2.80-kev resonance in sodium were measured with a reactor beam and various combinations of boron and sodium filters. Neutron total cross sections for K^{41} and Y^{89} were completed up to 20 kev and for Rb^{87} up to 15 kev. Data are presented for differential elastic neutron scattering from beryllium for neutron energies of 0.73, 1.00, 1.21, 1.50, 1.75, and 2.15 Mev. Phase shifts for neutrons scattered elastically by C^{12} were fitted to data previously reported. Neutron polarizations were calculated from these phase shifts. Experimental measurements on the scattering of neutrons from C^{12}, O^{16}, and Ne^{20} are summarized. The $S^{32}(n,\alpha)Si^{29}$ cross section was measured as a function of neutron energy in the range $1.4 \leq E_n \leq 3.0$ Mev. The fluorescence yields in the L shell were measured for a number of heavy Z elements, using a novel coincidence gamma-ray spectroscopy approach. Three new gamma rays were found in the decay of Xe^{133} with energies of about 160, 305, and 385 kev. The charge spectrum associated with the decay of the 5.3-day activity in Xe^{133} were measured, and the results were analyzed to yield a total conversion coefficient. A theoretical calculation of the angular distribution of fission fragments from oriented U^{233} nuclei is presented and is compared with observed results. The antiferromagnetic structure and the domain properties of $MnBr_2$ ($T_N = 2.16°K$) were determined. Neutron diffraction results are presented which prove that $MnCl_2$ has two distinct antiferromagnetic transitions at low temperatures. A scheme for enumerating possible magnetically ordered configurations on simple lattices is described, and a system of nomenclature descriptive of the arrangement is proposed. The trifluorides of chromium, iron, and cobalt have been found to order antiferromagnetically with a structure of the same type as that observed in similar perovskite-type compounds. The atomic-beam magnetic resonance apparatus has been used to measure the nuclear spin of I^{128}. A value of 1 was obtained. Results are presented of a comparison of some of the energy levels of atoms and ions of the second long period with predictions of simple theory, neglecting perturbations. Predictions of some levels in iodine(VI), iodine(IV), and iodine(III) are made. The resolved Zeeman patterns of 129 spectral lines of Pu(II) were measured and the g factors computed. The vibrational spectra of the nine isotopic ammonia molecules formed by D and T substitution and of the $N^{15}H_3$ molecule were studied. An improved sweeping pulse generator for the MC5 and similar multichannel analyzers is described. Continuing life tests on filamentary subminiature tubes show their life can be considered to be 20,000 hr. Various focusing gamma-ray collimators were field-tested in order to obtain an optimum design for brain tumor diagnosis. The mechanical design was completed for a scanning device that will be used to move a focusing collimator over a patient in order to determine the distribution of radioactivity within the body. (For preceding period see ORNL-2302.) (D.E.B.)

8001

CALCULATION OF SOME RELATIVISTIC CORRECTIONS TO THE ALLOWED AND 1-FORBIDDEN BETA TRANSITIONS. G. Alaga, L. Sips, and D. Tadic (Univ. of Zagreb). Nuclear Phys. 6, 305-9(1958) Mar. (3).

Making use of the non-relativistic form of the relativistic operators, the corrections have been computed to the allowed β transitions. The main contributions are of the order of magnitude $M^{-1}(\alpha Z/r_0)$, p/M and q/M. This may affect the spectra, angular correlations, K/β^+ ratios and half lives to the extent of a few per cent. It seems that these effects in some cases are within the precision of present day experimental technique and may provide additional information on β coupling constants. (auth)

8002

NON-CONSERVATION OF PARITY IN K-CAPTURE. M. Bernardini, P. Brovetto, S. Debenedetti, and S. Ferroni (Univ. of Turin). Nuovo cimento (10) 7, 419-21(1958) Feb. 1.

The non-conservation of parity is shown through the observation of right circular polarization of internal bremsstrahlung using a low-energy circular polarimeter with a Ge^{71} source. (W.D.M.)

8003

PROPOSED EXPERIMENT BEARING DIRECTLY ON HELICITY OF NEUTRINOS. L. A. Page (Univ. of Uppsala). Nuovo cimento (10) 7, 727-8(1958) Mar. 1.

Nuclear Properties

8004 NDA-2061-2

Nuclear Development Corp. of America, White Plains, N. Y.
THE RESONANCE STRUCTURE OF U^{235} CROSS SECTIONS. H. Goldstein, M. H. Kalos, D. Pomeroy, and N. Tralli. Mar. 25, 1957. 24p. For Pratt and Whitney Aircraft Div. $4.80(ph OTS); $2.70(mf OTS).

The statistical distributions of the resonance parameters of U^{235} are discussed and it is indicated how average cross sections can be calculated from these distributions. (W.D.M.)

8005 ORO-173

Arkansas. Univ., Fayetteville.
RECENT EXPERIMENTAL RESULTS ON ELECTRON-CAPTURING NUCLIDES. R. W. Fink. Mar. 1, 1958. 26p. Contract AT(40-1)-277. $4.80(ph OTS); $2.70(mf OTS).

Presented at the Nuclear Chemistry Symposium, American Chemical Society Meeting, San Francisco, Apr. 1958.

New data on transition energies involved in electron-capture decay and of mean L-fluorescence yields are given. Methods applied in the determination of x-ray intensity ratios and L/K-capture ratios are described. (M.H.R.)

8006 WAPD-TM-36

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MULTIGROUP NEUTRON CROSS SECTIONS: 54 NEUTRON GROUPS. Robert L. Hellens and Stephen J. Lukasik. Jan. 1957. 24p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

Neutron cross sections and the fission spectrum used with the MUFT-II and MUFT-III codes are tabulated for hydrogen, oxygen, zirconium, carbon, U^{235}, U^{238}, and B^{10} over the range 0.625 ev to 10 Mev. For each element the average cosine of the angle of deflection μ, the average logarithmic energy decrement per collision ζ, the number of neutrons per fission ν, capture, fission and elastic scattering cross sections are given in each of the 54 energy groups. In addition, resonance parameters and an inelastic scattering matrix are shown for U^{238}. (auth)

8007

ABSORPTION CURVES IN THE PHENOMONON OF NUCLEAR MAGNETIC INDUCTION. Corciovei Aretin. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 55-70(1957). (In Romanian)

8008

NUCLEAR MAGNETIC RESONANCE THEORY. Mioara Mugur. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 171-213(1957). (In Romanian)

A detailed analysis of the phenomenon of nuclear magnetic resonance is made and the conditions defined which produce absorption of nuclear magnetic resonance. The phenomenological theory of Bloch and the quantum statistical theory of Wangsness and Bloch are discussed. (J.S.R.)

8009

EXPERIMENTAL INSTALLATIONS FOR THE OBSERVATION OF NUCLEAR MAGNETIC RESONANCES. A. Valeriu, M. Drăghicescu, B. Ianculovici, and P. Drăghicescu. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 213-34(1957). (In Romanian)

The theoretical factors in experimental apparatus for the study of nuclear magnetic resonance are discussed. Then two types of installations are considered—apparatus with passive circuit and apparatus of the autodyne type. (J.S.R.)

8010

THEORETICAL BASIS FOR NUCLEAR SHELL MODELS. R. Weiner. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 359-77(1957). (In Romanian)

A survey is given of the theoretical basis of the nuclear shell model. 63 references. (J.S.R.)

8011

CONTRIBUTION TO THE EXPERIMENTAL STUDY OF EXCITED LEVELS OF SOME LIGHT NUCLEI BY THE METHOD OF ANGULAR CORRELATION OF INTERNAL CONVERSION PAIRS AND MONOPOLAR PAIRS. Raymond Armbruster. Ann. phys. 3, 88-122(1958) Jan.-Feb. (In French)

A concise theory of the angular correlation of internal conversion pairs and monopolar pairs is explained. The complete formulas are indicated which were used to calculate all the angular correlations of the experiments. A beta scintillation spectrometer is described. The angular correlation experiments are described. A precise measurement was made of the angular correlation of monopolar pairs from the 6.05-Mev level of O^{16}. It was possible to give the direction of the monopolar spectrum for different angles formed by the directions of emission of the electron and the positron. The multipolarity of the levels of C^{13} and C^{12}, respectively, was determined by a method of angular correlation of the internal conversion pairs. The angular moments, the parity, and the isobaric spin of two excited levels of C^{12} are given—2^-, T = 1 for the 16.57-Mev level and 1^-, T = 1 for the 17.22-Mev level. (tr-auth)

8012

ISOMERIC STATE IN Bi^{206}. E. Arbman and P. A. Tove (Univ. of Uppsala). Arkiv Fysik 13, 61-7(1958).

A half-life of 7.8 ± 0.3 μsec has been measured for the 59.9 kev E2 transition in Bi^{206}. Delayed coincidence studies show that all strong gamma rays from the decay of Po^{206} precede the 59.9 kev transition. The spins of the levels in Bi^{206} are discussed. (auth)

8013

MEASUREMENT OF ν_{eff} AND $\sigma_f + \sigma_c$ FOR FAST NEUTRONS ON U^{235} AND Pu^{239}. V. N. Andreev. Atomnaya Energiya 4, 185-6(1958). (In Russian)

Measurements were made of the parameters ν_{eff} and $\sigma_f + \sigma_c$ of U^{235} and Pu^{239} for fast photoneutrons with the energies 24 kev (from Sb–Be), 240 kev (from Na–D_2O), and 880 kev (from Na–Be). The measurements were made in spherical geometry, which cancelled out the elastic scattering in the first approximation. The degree of neutron absorption in the spheres was determined with a U^{235} fission chamber placed alternately within the center of the sphere or outside of it; the secondary fission neutrons in the sphere center were recorded with a U^{238} chamber, and the associated effects were subtracted from the records of of the chamber with U^{235}. The accuracy was 0.2 to 0.4%. The data were based on assumptions that either excluded the presence of the photoneutron elastic scattering in spheres or considered the U^{235} detector as not sensitive to inelastic neutron scattering. Neither assumption is exactly true, but the available data show that the effect alters the ν_{eff} not more than 5% for U^{235} and even less for Pu^{239}. (R.V.J.)

8014

PROMPT NEUTRON NUMBERS FOR THE FAST NEUTRON FISSION OF U^{235}, U^{238}, Th^{232}, AND Np^{237}. B. D. Kuzminov, L. S. Kutsaeva, and I. I. Bondarenko. Atomnaya Energiya 4, 187-8(1958). (In Russian)

8015

MEAN PROMPT NEUTRON NUMBERS IN THE FISSION OF U^{233}, U^{235}, AND Pu^{239} BY 4 AND 15 Mev NEUTRONS. G. N. Smirenkin, I. I. Bondarenko, et al. Atomnaya Energiya 4, 188-90(1958). (In Russian)

Corrections were made for the ratio of ν/ν_t in U^{233}, U^{235}, and Pu^{239} fission by 4 and 15 Mev neutrons. Corrections for the ν/ν_t magnitudes are tabulated. (R.V.J.)

8016

THE CROSS SECTION OF Th^{232} AND Np^{237} FISSION BY 14.6 Mev NEUTRONS. A. N. Protopopov, Yu. A. Selitskii, and S. M. Solovev. Atomnaya Energiya 4, 190-1(1958). (In Russian)

The cross sections of Th^{232} and Np^{237} fission by 14.6 Mev neutrons were measured to correlate the existing data. The calculations show for Th^{232} the value $\sigma = 0.35 \pm 0.02$ barns and for Np^{237} the value $\sigma = 2.4 \pm 0.2$ barns, which is in good agreement with data given by other authors. (R.V.J.)

8017

INELASTIC CROSS-SECTIONS OF SOME LIGHT ELEMENTS FOR 14 Mev NEUTRONS. V. M. Gorbachev and L. B. Poretskii. Atomnaya Energiya 4, 191-2(1958). (In Russian)

The inelastic cross sections for 14 Mev neutron interactions with Li^6(90%) and Li^7(99%), beryllium, boron, and carbon were measured. The results show that the cross sections are not a monotonous function of mass number. (R.V.J.)

8018

SIGNS OF NUCLEAR RESONANCE OBTAINED BY DYNAMIC POLARIZATION. André Landesman. Compt. rend. 246, 1538-40(1958) Mar. 10. (In French)

The nuclear resonance of F^{19} and Li^7 has been observed in a magnetic field of 72 oersteds by a dynamic polarization method. (tr-auth)

8019

PERIOD OF THE E_1 RAY OF 50 kev AND OF THE LEVEL AT 286 kev IN Ra^{225} (AcX). Hamlet Vartapetian. Compt. rend. 246, 1680-3(1958) Mar. 17. (In French)

By the method of α-γ and γ-γ delayed coincidences, it is shown that the 286-kev level has a period $T_{1/2} = (7.7 \pm 0.7) \times 10^{-10}$ sec and the E1 ray of 50 kev has a period $T_{1/2} = (6.3 \pm 0.7) \times 10^{-10}$ sec. A factor of forbiddenness of 10^3 was also obtained for the 50 kev E1 radiation normally converted in the levels L_I, L_{II}, and L_{III}. (tr-auth)

8020

THE INTERNATIONAL CONFERENCE AT REHOVOT ON NUCLEAR STRUCTURE. A. Ascoli. Energia nucleare (Milan) 5, 169-74(1958) Mar. (In Italian)

The International Conference on Nuclear Structure held at Rehòvot, Israel State, October 1957, is described in this paper. Some details are given on the session concerning "Parity non-conservation" owing to the present interest of such subject. (auth)

8021

INHOMOGENEOUS BROADENING OF MAGNETIC RESONANCE LINES. A. M. Clogston (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 29, 334-6(1958) Mar.

An inhomogeneously broadened magnetic resonance line is narrowed by dipole fields. The theory of this effect is developed in terms of the classical equations of motion of a magnetized medium by expanding the magnetization and fields into Fourier series. An expression is obtained for the imaginary parts of the susceptibility tensor. In the applicable range of the theory, the line width decreases inversely as the magnetization, and is strongly shape dependent. (auth)

8022

ON THE LEVEL DENSITY OF DEFORMED NUCLEI. Torleif Ericson (Univ. of Copenhagen and Univ. of Lund, Sweden). Nuclear Phys. 6, 62-81(1958) Mar. (2).

A simplified unified model is applied to a statistical calculation of the level densities of deformed nuclei. Configurations of nucleons of the same kind and in the same orbit are favored by a pairing energy. With increasing energy more and more pairs are broken and the spin and parity of the levels are entirely determined by the unpaired nucleons and the collective modes of excitation. The validity of the model at higher excitation is discussed. The parameters entering the final expression for the level density are known in principle. (auth)

8023

CORE EFFECTS IN LIGHT NUCLEI. G. Barton (Clarendon Lab., Oxford). Nuclear Phys. 6, 100-1(1958) Mar. (2).

The reduced matrix element of the first excited to ground state transition ($2S_{\frac{1}{2}} \rightarrow 1D_{\frac{5}{2}}$) has been calculated for F^{17}, and the core effects of F^{17} and O^{17} are compared. (A.C.)

8024

ROTATIONAL CHARACTER OF THE TRANSITION FROM THE 473 kev LEVEL IN Tm^{169}. O. Nathan and I. Marklund (Univ. of Copenhagen). Nuclear Phys. 6, 102-6(1958) Mar. (2).

The lifetime of the 473 kev state of Tm^{169} is investigated by means of a β-ray spectrometer operated in coincidence with a NaI scintillation detector. An upper limit of $\approx 5 \times 10^{-9}$ sec is obtained for the half life, which is consistent with a rotational interpretation of this state. (auth)

8025

MOMENTUM DEPENDENCE OF THE NUCLEAR SHELL MODEL POTENTIAL. R. B. Hall (Kings Coll., Cambridge, Eng.) and R. J. Eden (Clare Coll., Cambridge, Eng.). Nuclear Phys. 6, 157-60(1958) Mar. (3).

The momentum dependence of the shell model potential near the edge of the O^{16} nucleus is investigated by taking the average of an assumed form of pseudo-potential acting between pairs of nucleons. The reduced mass approximation is used and the variation of m^* is calculated as a function of nuclear density. (auth)

8026

EXCITED LEVELS OF ^{155}Gd. A. Bisi and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuclear Phys. 6, 252-9(1958) Mar. (3).

The decay of Eu^{155} was investigated by means of a scintillation spectrometer, proportional counter spectrometer, and coincidence technique. A level scheme of Gd^{155} is proposed. (auth)

8027

TOTAL CROSS SECTIONS FOR NEUTRON ENERGIES NEAR 14 Mev. J. F. Vervier and A. Martegani (Univ. of Louvain, France). Nuclear Phys. 6, 260-70(1958) Mar. (3). (In French)

The total cross section of C, Mg, Al, Fe, Cu, Pb, and U has been measured for neutron energies near 14 Mev by transmission experiments with good geometry. The agreement with previous measurements is satisfactory; the general form of total cross section curves is the same for elements with neighboring A-values; giant resonances have been found for C, Mg, and Al. The "strong coupling model" is not valid in this energy region, but the results agree qualitatively with the "intermediate coupling model." (auth)

8028

THE RELATIVISTIC LIMIT OF THE THEORY OF SPIN ½ PARTICLES. M. Cini and B. Touschek (Univ. of Rome). Nuovo cimento (10) 7, 422-3(1958) Feb. 1.

A transformation is presented which leads to a form of the Hamiltonian in which positive and negative spirality states are separately described by two component wave functions. (W.D.M.)

8029

THE DECAY OF LONG-LIVED HOLMIUM 166. M. A. Grace, R. T. Taylor, and P. B. Treacy (Clarendon Lab., Oxford). Phil. Mag. (8) 3, 90-6(1958) Jan.

The decay of long-lived Ho^{166} is discussed and results are given which suggest that the 817 and 718 kev γ-rays are each in competition with separate cascade pairs of energies 537 + 280 kev and 438 + 280 kev, respectively. A level scheme is proposed consistent with the existence of a low lying rotational spectrum in the product nucleus Er^{166}. (auth)

8030

THE HALF-LIFE OF THALLIUM 196 AND THE MULTIPOLARITY OF THE 426 kev TRANSITION IN MERCURY 196. G. Andersson, J. O. Burgman, and B. Jung (Gustaf Werner Inst. for Nuclear Chemistry, Uppsala). Phil. Mag. (8) 3, 105-6(1958) Jan.

The conversion lines of the 426-kev gamma transition in Hg^{196} were reinvestigated using mass separated sources at about 0.3% resolution in a double-focusing β spectrometer. The half life of the K line in A = 196 was measured as (1.8 ± 0.1) hr and the K/L ratio as 2.75 ± 0.28, in good agreement with the value of 2.86 obtained for electric quadrupole radiation by interpolation from Rosés tables (1954 - 1956). Some observations are made concerning the half life of Tl^{196}. The present investigation illustrates the difficulties encountered in nuclear spectroscopic work on mixtures of several nuclides and emphasizes the importance of mass separated samples. (A.C.)

8031

THE POSITRON DECAY OF THE GROUND STATE OF ALUMINIUM-26. P. S. Fisher and D. W. Hadley (Univ. of Birmingham, Eng.) and G. Speers (Radiochemical Centre, Amersham). Phil. Mag. (8) 3, 163-9(1958) Feb.

An investigation has been made of the long-lived ground state of Al^{26}. The gamma ray spectrum has been determined with a scintillation spectrometer, and the half life calculated both by comparing the ratio of the masses of Al^{26} and Al^{27} in the source and by comparison of reaction cross sections, the value obtained being 0.8×10^6 years (±30%). The positron spectrum, measured using an overcompression cloud chamber, is consistent with that expected for a unique second forbidden transition, thus helping to confirm that the ground state of Al^{26} is a 5+ level, decaying to a 2+ excited level in Mg^{26}. An Appendix

describes the radiochemical separation procedure for extraction of the active aluminum from the magnesium targets. (auth)

8032

RADIO-FREQUENCY ORIENTATION OF As^{76}. F. M. Pipkin and J. W. Culvahouse (Harvard Univ., Cambridge, Mass.). Phys. Rev. 109, 1423-39(1958) Mar. 1.

Measurements are reported on the successful orientation of 26-hour As^{76} donors in a doped silicon crystal. A general discussion is given of the various methods of dynamic nuclear orientation and how they apply to As^{76}. The use of radio-frequency orientation to determine the sign of the nuclear magnetic moment and the mixture of total angular momenta carried off by the electron-neutrino system is discussed. As^{76} has been oriented by both saturation of forbidden transitions and double resonance methods. The hyperfine splitting of As^{75} in the doped silicon crystal is $+198.42 \pm 0.04$ Mc/sec; the hyperfine splitting of As^{76} in the same crystal is -93.660 ± 0.06 Mc/sec. The spin of As^{76} has been shown to be 2; its gyromagnetic ratio, -0.4514. The determination of the relative amounts of angular momenta carried off by the $2^- \rightarrow 2^+$, 2.41-Mev beta ray gives a result which is consistent with 5 parts L = 0, 2 parts L = 1, and 3 parts L = 2. An unknown systematic error in these last measurements makes it difficult to say precisely what the mixture is. Unsuccessful attempts to produce orientation through the Overhauser and Abragam methods are summarized. (auth)

8033

NEUTRON SCATTERING CROSS SECTION OF U^{235}. H. L. Foote, Jr. (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1641-4(1958) Mar. 1.

The neutron elastic scattering cross section for U^{235} has been measured by the "thick-thin" method over the range of neutron energies from 0.27 to 7.7 ev. The cross section rises at lower energies, the rise being qualitatively that expected if an unusually strong level were present just below the binding energy. Analysis of the data in terms of a Breit-Wigner single-level formula gives a resonant and a constant component. The solution yields a value of 10 ± 1 barns for the constant component, which may be identified as the "potential scattering" cross section. This result is relatively insensitive to the location of the bound level and to the exact analytical form of the resonant component. The magnitude of the resonant component is not in perfect quantitative agreement with the parameters commonly quoted for the "negative energy" resonance at $E_0 = -1.4$ ev. This disagreement is probably not significant because of the uncertainties in the analysis of both the total and the scattering cross section. (auth)

8034

NEUTRON SCATTERING CROSS SECTION OF U^{233}. Sophie Oleksa (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1645(1958) Mar. 1.

The neutron scattering cross section of U^{233} as a function of energy has been measured by means of a crystal spectrometer in the energy range 0.27 to 0.95 ev and at 2.09, 2.71, and 3.31 ev. Least-squares analyses of these data indicate that at these energies the scattering cross section is approximately constant, i.e., 12.5 ± 0.5 barns. (auth)

8035

ANGULAR CORRELATIONS OF GAMMA RAYS IN CASCADE FROM LEVELS IN Lu^{175} AND Hf^{177}. Ernest D. Klema (Oak Ridge National Lab., Tenn.). Phys. Rev. 109, 1652-5(1958) Mar. 1.

The directional angular correlations of the 208.36–112.97 kev gamma-gamma cascade in Hf^{177} and the 89.36–343.40 and 282.57–113.81 kev cascades in Lu^{175} have been measured with a coincidence scintillation spectrometer using NaI detectors. The observed correlation functions obtained with dilute aqueous solution sources are $W(\theta) = 1 - (0.1614 \pm 0.0015)P_2(\cos\theta)$, $W(\theta) = 1 + (0.001 \pm 0.004)P_2(\cos\theta)$, and $W(\theta) = 1 + (0.221 \pm 0.004)P_2(\cos\theta)$, respectively. These results, taken together with conversion coefficient measurements, indicate that δ^2 for the 282.57-kev gamma ray in Lu^{175} is 0.05. The sign of δ, defined below, is positive. The mixing ratio of the 208.36-kev gamma ray in Hf^{177} is M2/E1 = 0.001; in this case the sign of δ is negative. The sign of δ for the 113.81-kev gamma ray in Lu^{175} is positive, and the sign of δ for the 112.97-kev gamma ray in Hf^{177} is negative. (auth)

8036

NUMERICAL SOLUTIONS OF THE CURIUM-242 ALPHA-DECAY WAVE EQUATION. John O. Rasmussen and Eldon R. Hansen (Univ. of California, Berkeley). Phys. Rev. 109, 1656-63(1958) Mar. 1.

Numerical integration of the previously derived alpha-decay wave equation, including electric quadrupole coupling terms, was carried out for Cm^{242} including l = 0, 2, 4, and 6 partial waves. Eight integrations were carried inward in spherical polar coordinates on an IBM-650 computer with different initial conditions, such that a complete set of eight linearly independent solutions to the system of coupled equations was generated. Eight different linear combinations of this base set were found which satisfy the boundary conditions imposed by experimental Cm^{242} alpha-group intensities. Wave amplitudes on a spherical surface near the nucleus are given for all eight cases, and the radial variation throughout the barrier region is given for two cases. The matrix formalism of Fröman is employed in another presentation of the results, and a comparison is made with the analogous Fröman matrix. By using a modified Fröman matrix together with our results, the alpha-wave distributions are calculated for a spheroidal nuclear interaction surface. A discussion is made of conditions for the existence of solutions satisfying boundary conditions imposed by alpha-group intensities, and the quadrupole phase shift problem is considered. (auth)

8037

SHELL-MODEL THEORY OF Pb^{206}. William W. True (Indiana Univ., Bloomington) and Kenneth W. Ford (Indiana Univ., Bloomington and Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 109, 1675-97(1958) Mar. 1.

A detailed nuclear shell model calculation of the energy levels and gamma-ray transition rates in Pb^{206} is carried through. For pure singlet two-body forces with the same effective range and strength as for the low-energy two-body system, energy level agreement is good—for 13 known levels, the mean discrepancy between theory and experiment is 0.057 Mev. For singlet forces 75% as strong as for the low-energy two-body system, plus weak coupling to collective vibration, the energy level agreement is somewhat better—the mean discrepancy between theory and experiment is 0.035 Mev per level. In the latter theory, the strength of collective motion is determined from the known Coulomb excitation cross section in Pb^{206}. In either theory, the calculated transition rates are in qualitative accord with experiment, but quantitative agreement is lacking. Electric quadrupole transition rates are shown to be describable in terms of a neutron effective charge. The effective charge is about 1.15e and the same in Pb^{206} as in Pb^{207}. Other calculated quantities in good agreement with experiment are the relative cross sections to final p states in the $Pb^{206}(d,p)Pb^{207}$ reaction and the difference in binding energies of the last neutron in Pb^{206} and Pb^{207}. The results are shown to be insensitive to substantial amounts of triplet-odd force, either attractive or repulsive. (auth)

8038

FURTHER STUDY ON THE DECAY OF ^{57}Ni. J. Konijn, H. L. Hagedoorn, and B. Van Nooijen (Laboratorium voor technische physica der Technische Hogeschool, Delft, Netherlands). Physica 24, 129-36(1958) Feb.

The radioactive decay of Ni^{57} has been reinvestigated in more detail. In contradiction to earlier results only three γ rays have been found; the 127 kev γ ray transition is weaker than reported before and occurs only in $(14 \pm 1)\%$ of the Ni^{57} disintegrations. The intensities of possible γ rays of 400 kev and 520 kev are found to be smaller than 0.5% and 1%, respectively. The ϵ/β^+ ratios have been determined separately; the results are in agreement with theoretical predictions by Zweifel, the Fierz terms therefore are small. The fluorescent yield of Co^{57} has been measured as $\omega_K = 0.31 \pm 0.01$. (auth)

8039

NUCLEAR CROSS SECTIONS FOR 765 Mev NEUTRONS. N. E. Booth, G. W. Hutchinson, and B. Ledley (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 71, 293-304(1958) Mar.

Total cross sections have been measured for the elements H, D, Li, C, O, Al, Cu, Sb, and Pb and absorption cross sections for C, Al, Cu, and Pb for neutrons of an effective energy of 765 ± 30 Mev. The neutrons were detected by observing the Cherenkov light from charged secondaries produced in a cylinder of Perspex. Large corrections must be applied to the measured absorption cross sections and these are strongly dependent upon the differential cross section assumed. The results are compared with an optical model with a potential distribution indicated by electron scattering measurements, and with an imaginary central potential and a real spin–orbit potential. The results can be adequately represented by assuming that at this energy the imaginary potential is given by the free nucleon–nucleon total cross sections and that the nuclear potential size and shape agree with the charge density size and shape. The spin–orbit coupling parameter required to fit the results is somewhat less than that found at lower energies. (auth)

8040

ON THE DETERMINATION OF THE ELECTRON CAPTURE DECAY ENERGY: ^{196}Au. R. K. Gupta (Tata Inst. of Fundamental Research, Bombay). Proc. Phys. Soc. (London) 71, 330-4(1958) Mar.

A single crystal scintillation spectrometer has been utilized to detect the triple summing, in the crystal, of three coincidence radiations. It has been shown that in an electron capture isotope the triple sum of two cascade γ rays and K x ray, which precedes the emission of γ rays, can be used to calculate the ratio P_L/P_K for the transition to the second excited state of the daughter isotope. The ratio P_L/P_K can also be calculated by recording triple coincidence rate with two coincidence spectrometer units, by detecting the sum of two γ rays in one and K, x rays in the other unit. These methods have been used to calculate the decay energy of Au^{196}. The decay energy has been found to be 911^{+55}_{-25} kev. (auth)

8041

THE β-DECAY OF ^{185}W. B. H. Armitage and W. G. V. Rosser (Univ. of Exeter, Eng.). Proc. Phys. Soc. (London) 71, 335-40(1958) Mar.

It is shown that the 56 kev γ ray observed from natural tungsten irradiated in the pile does not arise from the decay of W^{185} as was suggested by Bisi, Terrani, and Zappa (1955). The γ-ray peak at 125 kev probably arises from a 0.005% branching ratio to the 125-kev excited level in Re^{185}. The continuous photon spectrum is interpreted quantitatively as internal plus external bremsstrahlung. (auth)

8042

A NEW ISOTOPE OF OSMIUM. P. Rey and G. B. Baró (Comisión Nacional de Energía Atómica, Buenos Aires). Publs. com. nacl. energía atómica (Buenos Aires) Ser. quím. 1, No. 10, 115-28(1957). (In Spanish)

A new osmium isotope was found by irradiation of platinum with fast neutrons. The osmium activities produced were separated from the mixture by distilling osmium tetroxide twice. In this fraction an activity of 6.5 min. half life could be attributed to the so far unknown Os^{195}. It was produced by the following reaction: $Pt^{198}(n, \alpha)Os^{195}$. The maximum β energy was determined by a Feather analysis and found to be 2 Mev. It was easy to identify this new osmium isotope since it decays to the well known Ir^{195}(2.2 hr half life). The genetic relationship was proved by Ir separation at equal and known intervals from the osmium fraction. F. D. S. Butement and A. J. Poe's values for Ir^{195} and Os^{193} could be confirmed. (auth)

8043

NUCLEAR RESONANCE FLUORESCENCE IN O^{16}. B. Duelli and L. Hoffmann (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 13a, 204-8(1958) Mar. (In German)

The reaction $F^{19}(p,\alpha\gamma)O^{16}$ produces γ radiation by the direct transition of the 7.12 Mev(1^-), 6.91 Mev(2^+), and 6.14 Mev(3^-) levels to the ground state (0^+) of the O^{16} nucleus. Because of the O^{16*} recoil, produced by the preceding α emission, a Doppler displacement of the γ line occurs. Resonance fluorescence is therefore expected when the impact loss of the quantum is compensated for by the emission and absorption through the Doppler effect. The experiment shows that the 7.12 and 6.91 Mev levels can be excited, but not the 6.14 Mev level. From the effective cross section as well as from the (p,α) and the (α,γ) distribution of the calculated Doppler spectra, low values can be obtained for the life of both excited states. (tr-auth)

8044

MEASUREMENT OF THE ANGULAR CORRELATION OF THE 208 kev/113 kev $\gamma-\gamma$ CASCADE OF Hf^{177} IN SOLID AND LIQUID SOURCES. H. J. Behrend (Physikalischen Staatsinstitut, Hamburg). Z. Naturforsch. 13a, 211-15 (1958) Mar. (In German)

Measurement of the angular correlation of the 208 kev/113 kev $\gamma-\gamma$ cascade shows a dependence of the anisotropy on the characteristics of the sources. For $W(\theta) = \Sigma A_{2K} P_{2K} (\cos\theta)$ in a water solution of $LuCl_3$ as source the coefficients $A_0 = 1.0000 \pm 0.0017$, $A_2 = -0.1627 \pm 0.0032$, and $A_4 = 0.0024 \pm 0.0042$ were obtained. For the 113 kev radiation a mixture of 95.9% E2 and 4.1% M1 appeared, and for the 208 kev transition an E1 radiation with an M2 mixture of 1.5% maximum appeared. Finally, from the measured diminished angular correlation the electric field gradients responsible for the diminishing were estimated. (tr-auth)

8045

THE DETERMINATION OF THE HALF LIFE OF Re^{187}. W. Herr and E. Merz (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 13a, 231-3(1958) Mar. (In German)

The decay constant of the very low energy β radiation of Re^{187} was determined by chemical analysis of mother and daughter substances in various minerals. A special neutron activation and mass technique permitted the quantitative determination of the trace elements Re and Os to approximately 10^{-7}%. The Os^{187} abundance measurements were made by neutron activation analysis. The mineral

age could be calculated partially by the proved U/Pb method. From these measurements was obtained a half life for Re^{187} of $5.5 \leqq T \leqq 6.8 \times 10^{10}$ years. The hypothesis was used for the dating of 18 minerals of definite localities according to the Re/Os method. A half life of 6.2×10^{10} years was used as the basis of the dating. These values were in good agreement with other datings. (tr-auth)

8046
HYPERFINE STRUCTURE AND THE STRUCTURE OF NUCLEONS. E. Werner (Univ. of Saarland, France). Z. Naturforsch. 13a, 238-9(1958) Mar. (In German)

Nuclear Reactors

Refer also to abstracts 7847, 8233, and 8234.

8047 AECD-4262
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
FUNCTIONAL REQUIREMENTS FOR THE PWR CONTROL ROD MECHANISMS. J. Sherman and L. S. Mims. Nov. 1955. Decl. Apr. 14, 1958. 20p. Contract [AT-11-1-GEN-14]. (FR-0272-B; M-6020). $3.30(ph OTS); $2.40 (mf OTS).

The general operational and dimensional characteristics of the mechanisms are defined, and detailed lists of critical dimensions, ambient conditions, and power requirements are given. (D.E.B.)

8048 AECU-3652, AECU-3653, and AECU-3654
Atomic Power Development Associates, Inc., Detroit.
SUMMARY REPORTS—APDA ACTIVITIES [FOR] JULY, AUGUST, SEPTEMBER 1957. (July, 9p.; Aug., 10p.; and Sept., 11p.) (AECU-3652 and AECU-3653 $1.80(ph OTS); $1.80(mf OTS) ea. and AECU-3654 $3.30(ph OTS); $2.40 (mf OTS)).

These three reports were issued separately, but are cataloged as a unit.

Brief summaries of Fermi Fast Breeder Reactor design, development, and component procurement progress are given. Pressure vessel fabrication and fuel pin testing are discussed. (For preceding period see APDA-315.) (D.E.B.)

8049 AECU-3656
Knolls Atomic Power Lab., Schenectady, N. Y.
THE EFFECT OF NITROGEN-COVERED-SODIUM ON S2G STRUCTURAL MATERIALS. G. C. Wheeler. Mar. 21, 1957. 23p. Contract [W-31-109-Eng-52]. $4.80 (ph OTS); $2.70(mf OTS).

Tests were made to determine the effects on structural materials of using nitrogen as a cover gas for the liquid sodium in the S2G system. Various materials including beryllium, 18-4-1 tool steel, and 347 stainless steel were exposed to N_2-covered Na, both flowing and static, at temperatures of 600 to 1100°F. The effects of several variables, including temperature, irradiation and sodium flow rate, were investigated. The effects on the specimens were monitored by weight and dimensional changes, metallographic and x-ray examinations, and mechanical tests. Many of the materials, including beryllium, tool steel and stainless steel were found to nitride. The nitrides of stainless steel and tool steel form an adherent "case" on the metal surface, but are more readily corroded than their parent metals. Thus, in flowing Na no case is formed except on protected portions of the metal surface, while in static Na a case is formed which increases in thickness with increasing time. In flowing Na the mutually competing reactions of case formation and corrosion, plus solubility of N_2 in the metals, make the weight changes unreliable as indices of metal loss, even for beryllium, whose nitride is inadherent. Consequently, directly-measured metal losses must be used to follow the reaction rates in flowing sodium. The effects of sodium-produced nitride cases on mechanical properties of stainless steel specimens were studied by tensile, stress-rupture, internal-pressure stress-rupture, and strain-fatigue tests at various temperatures. At temperatures up to at least 850°F, the strength, ductility, and strain fatigue resistance of nitrided specimens are markedly lower than those of unnitrided specimens. The observed changes in ductility and fatigue strength result from the brittleness of the case, and the consequent production of surface cracks in the specimens at relatively low strains. (auth)

8050 ANL-5840
Argonne National Lab., Lemont, Ill.
FUSED SALTS AS THERMONUCLEAR REACTOR BREEDER BLANKETS. D. M. Gruen. Mar. 1958. 8p. Contract W-31-109-eng-38. $0.50(OTS).

The use of fused lithium nitrate as a breeding material for thermonuclear reactors is proposed. Some of the properties of $LiNO_3$ such as thermal stability, radiation stability, neutron reaction products, and corrosive effects are briefly considered. Further studies are suggested. (D.E.B.)

8051 APAE-25
Alco Products, Inc., Schenectady, N. Y.
LITERATURE SURVEY FOR ACTIVITY BUILD-UP ON REACTOR PRIMARY SYSTEM COMPONENTS. A. L. Medin, ed. Jan. 15, 1958. 79p. Contract AT(11-1)-318. $2.25(OTS).

A survey was made of the possible build-up of long-lived radioactivity on primary system components with increased reactor operation. Parameters and mechanisms that may contribute to this activity build-up are discussed. The activity build-up was attributed to either deposition and/or atom exchange. Experimental data to-date is not sufficient to conclusively attribute the degree to which each of these mechanisms contribute to the build-up. The need for experimental information, especially for reactors employing stainless steel clad fuel elements, is discussed. Theoretical equations to predict the extent of the activity build-up are discussed. To-date these equations have not been accurate in predicting the build-up of long-lived nuclides. Decontamination of primary system components may be required to remove this build-up. A discussion of present-day decontamination agents and their application is discussed. (auth)

8052 APAE-Memo-97
Alco Products, Inc., Schenectady, N. Y.
EFFECT OF APPR-1 CONTROL ROD ACCELERATION AFTER SCRAM ON STARTUP ACCIDENT. J. G. Gallagher and T. M. Silks. Apr. 23, 1957. Decl. Mar. 13, 1958. 17p. Contract AT(11-1)-318. $3.30(ph OTS); $2.40(mf OTS).

In the preoperational checkout of the APPR-1 it became apparent that the control rod acceleration after scram was lower than expected. It was expected that the control rod acceleration after scram would be 0.750 g(1) where g is the acceleration of gravity. However, measurements made at Ft. Belvoir indicated an acceleration of 0.4 g. The effect of this reduced acceleration on the safety of the APPR-1 is reported in this memo. In the operation of the APPR-1 the most dangerous condition exists at cold startup. Therefore the behavior of the APPR-1 in a startup accident with a rod acceleration of 0.4 g after scram is considered. Analysis of the most adverse startup accident in the APPR-1 indicated that at the 15 Mw level scram the

reactor is on a 33 ms. period. Rod insertion begins after a 50 ms. instrument delay, at which time the power is 80 Mw. The maximum power reached with a rod acceleration of 0.4 g is 96.5 Mw. The total energy released is about 5.8×10^3 Btu which is far below the 8×10^4 Btu which would result in melting at the center line of the fuel element (and probable core destruction). If the rod acceleration were 0.759 g the maximum power would be between 80 and 90 Mw so that the reduced acceleration does not constitute any significant increase in energy release on a starting accident. (auth)

8053 BMI-1258
Battelle Memorial Inst., Columbus, Ohio.
STUDIES OF UPPER-PLENUM COOLANT CIRCULATION IN A QUARTER-SCALE AIR-FLOW MODEL OF THE PWR. Alexander R. Orban and Herbert R. Hazard. Mar. 18, 1958. 44p. Contract W-7405-eng-92. $1.25(OTS).

Air-flow studies were run in a quarter-scale flow model of the PWR to determine distribution of flow throughout the upper-plenum region with two different hold-down-barrel designs. With each hold-down barrel, flow paths were determined for operation with four loops, three loops, two opposed loops, and two adjacent loops. Exploration of flow patterns and velocities throughout the upper plenum showed that circulation of coolant throughout the upper plenum was satisfactory with either of the hold-down barrels investigated. (auth)

8054 CF-52-8-226(Del.)
Oak Ridge School of Reactor Technology, Tenn.
A PRELIMINARY STUDY OF THE FEASIBILITY OF A GAS-COOLED, GRAPHITE-MODERATED REACTOR FOR POWER PRODUCTION. Reactor Design and Feasibility Problem. D. B. Willmer, J. H. Crowley, Z. Levine, R. G. Mallon, M. Potter, J. B. Stichka, and J. T. Thomas. Aug. 20, 1952. Decl. with deletions Feb. 20, 1957. 121p. $18.30(ph OTS); $6.00(mf OTS).

The report covers the preliminary design of a helium-cooled, graphite-moderated nuclear reactor and the associated power producing system. The problem is approached with the viewpoint that the system need not represent the economically optimum design, but one which would serve as a pilot plant for future designs. The reactor is designed to operate well within the known limits of safety for the materials of construction, using only those materials which are available at the present time. The fuel is enriched (93.4%) U^{235} in the form of UO_2 inclusions in a stainless steel matrix and with a stainless steel cladding. The reactor is rated at 200 megawatts and the net electrical power output is 55 megawatts. The helium coolant for the reactor transfers its heat to a conventional steam power cycle. The capital cost, including chemical reprocessing and fuel fabrication plants, is estimated to be $39,000,000 and the cost of the electrical energy is 28 mils per kilowatt-hour. (auth)

8055 CF-54-7-63
Oak Ridge National Lab., Tenn.
PRELIMINARY COST ESTIMATION: CHEMICAL PROCESSING OR FUEL COSTS ASSOCIATED WITH A POWER STATION OF THREE K-23 REACTORS. E. D. Arnold, A. T. Gresky, A. R. Irvine, and R. J. Klotzbach. July 14, 1954. Decl. Nov. 13, 1957. 50p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30(mf OTS).

A cost estimation for chemical processing associated with a three-reactor power station of a proposed homogeneous breeder system, is presented. Results indicate unit costs in a power economy will be $11.18 per Mwd of heat or 2.00 mills per kilowatt-hour of electricity. (auth)

8056 CF-56-8-206
Oak Ridge School of Reactor Technology, Tenn.
HIGH FLUX RESEARCH REACTOR (HFRR). Reactor Design and Feasibility Study. R. D. Cheverton, A. W. Charmatz, R. L. Crowther, R. J. Feinberg, G. A. Mortensen, and T. G. Schleiter. Aug. 1956. 189p. $28.80(ph OTS); $8.40(mf OTS).

Feasibility studies of a high flux, solid fuel research reactor are presented. By means of a parameter study, a reactor consisting of a cylindrical fuel annulus submerged in heavy water is described. The thermal neutron flux peaks in the heavy water adjacent to the annulus and is a maximum in the region surrounded by the fuel annulus, while the minimum thermal flux occurs in the annulus. The fast flux has the opposite shape. Calculations indicate that practical peaking factors, ratios of maximum thermal flux in the heavy water to average thermal flux in the fuel annulus, as high as eight can be obtained. A typical reactor in which the maximum thermal and fast fluxes are greater than 10^{15} n/cm^2-sec is also described. (auth)

8057 CF-57-5-14
Oak Ridge National Lab., Tenn.
TWO-GROUP ANALYSIS OF THERMAL, ONE-DIMENSIONAL, MULTI-REGION SPHERICAL REACTORS. C. W. Nestor, Jr. May 1, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The formulation of a set of two-group neutron diffusion equations and the solution for the critical fuel cross section in a one-dimensional, multi-region spherical reactor are described. (auth)

8058 CF-58-3-76
Oak Ridge National Lab., Tenn.
MAXIMUM THERMAL FLUX PER Mw IN THREE-REGION HOMOGENEOUS REACTORS. T. B. Fowler. Mar. 18, 1958. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The maximum thermal flux per Mw of thermal power generated was calculated for a variety of critical three-region spherical homogeneous reactors. The central region contained H_2O or D_2O, the second or annulus region contained U^{235} and H_2O or D_2O, and the outside region contained D_2O. The outside radius was held constant at 152.4 cm while the radius of the central region and the thickness of the annulus were varied in order to ascertain the peak maximum thermal flux per Mw. The peak maximum thermal flux per Mw for the $D_2O-D_2O-D_2O$ system ranged from 8.07 to 9.75×10^{13} for central region radii varying from 2 to 30 cm. For the $H_2O-H_2O-D_2O$ system, peak $\phi^{Max.}/Mw > 3.2 \times 10^{14}$ for a central region radius of 5 cm and annulus thickness of 1 cm. (auth)

8059 CF-58-4-14
Oak Ridge National Lab., Tenn.
FISSION GAS HOLDUP TESTS ON HRT CHARCOAL BEDS. R. E. Adams and W. E. Browning. Apr. 2, 1958. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Fission gas holdup tests on the HRT charcoal beds under simulated operating conditions are complete. A radioactive tracer technique developed for use in laboratory absorption studies was utilized. The efficiency of the charcoal beds, in regard to holdup of fission gases, exceeds design specifications. On the basis of these tests, the charcoal beds should perform satisfactorily with the HRT operating at 10 Mw with a total oxygen flow of 3 liters/min. or at 5 Mw with a total oxygen flow of 3.5 liters/min., assuming that the maximum charcoal temperature in the first sections of the bed does not exceed 100°C and that the temperature in the 6 inch diameter section is in the 15 to 20°C range. (auth)

8060 CRE-681

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE NRU REACTOR. Lectures Given at Chalk River, Ontario, February–April 1956. M. D. Ferrier. May 1957. 249p. (AECL-507). $4.00(AECL).

Papers are included on: "Basic Reactor Structure"; "Rods (X,B,J), Vertical Plugs and Thimbles"; "Control and Shut-off Rod"; "Loop Facilities and Installation"; "Tray Rods, Rabbit Distribution System and Operation"; "Heavy Water and Helium Systems"; "Auxiliary Cooling Circuits I (J-rods and B-rods)"; "Auxiliary Cooling Circuits II (Reflector, Shields and other Auxiliary Circuits)"; "Reactor Air Cooling, CO_2 and Process Water Systems"; "Design Considerations of NRU Control and Safety Systems"; "Operation of NRU Control System"; "Reactor Instrumentation—especially Trip and Alarm Circuits"; "Electrical Supply Systems;" "Horizontal Experimental Hole Facilities and Flask"; and "Rod Handling." (M.H.R.)

8061 DP-265

Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.

POWER REACTOR STUDIES. Quarterly Progress Report [for] August, September, and October 1957. L. Isakoff, comp. Feb. 1958. 79p. Contract AT(07-2)-1. $2.25 (OTS).

An evaluation is made of gas cooling versus heavy water cooling for power reactors that are fueled with natural uranium metal and moderated with heavy water. The power reactors are designed to produce 100 Mwe. Basic physics data, engineering design problems, metallurgical developments, and estimates of the costs associated with the power reactors also are given. (For preceding period see DP-245.) (auth)

8062 DP-285

Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.

HEAVY WATER MODERATED POWER REACTORS. Quarterly Progress Report [for] November 1957 through January 1958. L. Isakoff, comp. Mar. 1958. 55p. Contract AT(07-2)-1. $1.50(OTS).

Continued study of natural-uranium-fueled, heavy-water-moderated power reactors has led to a preferred design. The reactor is of the pressure-vessel variety, is fueled with metallic tubes, is cooled with heavy water, and produces 100 Mwe. The future potential, basic physics data, engineering design problems, metallurgical developments, and estimates of the costs for this currently preferred type and alternative designs of D_2O-cooled-and-moderated reactors are discussed. (For preceding period see DP-265.) (auth)

8063 HW-54982

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLUTONIUM RECYCLE TEST REACTOR; POWER OUTAGE OPERATING PROCEDURES, EQUIPMENT AND PROCESS REQUIREMENTS. W. A. Burns. Feb. 19, 1958. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

An analysis of Plutonium Recycle Test Reactor operating requirements under conditions of electrical power failure has shown that the necessary levels of safety, experimental flexibility, and economy and ease of operation will be retained by: installing a 300-kw diesel-generator for emergency electrical power, increasing the storage capacity for compressed instrument air, installing a low-capacity, high-head boiler feedwater pump, providing for emergency light water injection into the calandria ring headers, separating the primary and moderator systems, connecting the fog spray system into the sanitary water system, providing helium purge shutoff valving at the pressurizer and installing piping from separate compressed helium storage to the pressurizer to permit pressurization of the primary system during periods of total loss of power, and installing a 10-kw d-c-powered alternator to supply instrument power. (auth)

8064 IDO-16430

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

QUARTERLY PROGRESS REPORT FOR MTR-ETR TECHNICAL BRANCHES, THIRD QUARTER, 1957. K. A. McCollom, ed. Dec. 16, 1957. 69p. Contract AT(10-1)-205. $2.00(OTS).

MTR-ETR Technical Assistance. The Engineering Test Reactor Critical Facility fuel loading was increased from a 49 element core to a 59 element core to give an excess reactivity of 11% in $\Delta k/k$. Statistical weights and thermal flux measurements were made throughout the core. A means of estimating variation in boron content in ETR fuel elements by comparing a standard fuel element with a dummy element and an element containing only fuel showed the average boron content per fuel element to be 0.65 grams more than the specified 1.6 grams. The equivalent total curie value of MTR fuel elements and the curie content of several specific isotopes were worked out. MTR-ETR Development. Four experimental shim rod magnets have already operated successfully without failure for longer than the average life of existing MTR shim rod magnets. The lower original cost, the replaceable coil feature, and the negligible maintenance for the experimental magnet should drastically reduce the maintenance attention presently required in the MTR. Refinements were made on the calculations of MTR fuel charge and xenon override. Prediction of MTR charge life was made using ingrowth of Xe^{135} after a power reduction. Methods of measuring both boron and fuel contained in ETR elements by chemical and non-destructive techniques are being evaluated. Hydraulic tests were made on four modifications of the ETR fuel element design. A study of the effects of varying parameters and changing design of fuel elements was conducted. Pre-irradiation metallographic examination of representative fuel sample plates was completed. Reactor Physics and Engineering. A method of obtaining the lethargy dependence of the flux, $\Phi(u)$, to obtain the fast group constants for group diffusion theory calculations was programmed for the IBM-650. The revised result of the yield of I^{135} was $4.1 \pm 0.6\%$ in the fission of plutonium. A thorium slug irradiated for a year in the MTR was sectioned and analyzed to obtain the distribution of uranium within the slug. No significant angular dependence about the axis of the slug was observed. Nuclear Physics. The major emphasis of the cross section program has been on understanding the fission process in U^{233}. Total cross section curves are given on Pu^{240}, Sm, Gd, Ca, Sr, and Li^7. The HG-6 beam hole plug for the inelastic-scattering-of-slow-neutrons program was installed in the MTR, and radiation and temperature measurements were made at an operating power of 40 Mw. In nuclear chemistry the Mo^{99}/Ag^{113} saturation activity ratios of the fission of U^{233} with thermal and 1.8 ev neutrons were compared with the latter result appearing larger by about 15%. In the decay schemes program, the machine calculated detection efficiencies of sodium iodide scintillation crystals are being checked experimentally. The decay schemes of Bi^{205} and La^{142} are being investigated. (For preceding period see IDO-16394.) (D.E.B.)

8065 IP-275 (Rpt: UNCLASSIFIED)
Michigan. Univ., Ann Arbor. Coll. of Engineering.
SUMMARIZATION OF STUDIES ON NUCLEAR HEAT ENGINE SYSTEMS. Frederick G. Hammitt. Apr. 1958. 145p.

Heat engine types as components of relatively lightweight, compact, mobile nuclear power plants are considered. Comparative efficiency data under conditions of similar inlet and outlet temperature were developed. Some preliminary evaluations of the probable costs and weights of the various types were made. In addition, economic optimizations under the special operating conditions of a nuclear power plant were made for several of the major components under varying conditions of working fluid, temperatures, pressures, and power outputs. The emphasis is on the suitability of the various heat engine systems. The heat engine types investigated are: steam systems—saturated, superheated, and supercritical; Rankine cycles using fluids other than water, including combination cycles employing two or more fluids; gas turbine cycles—open and closed, regenerative, non-regenerative, air and other gases as working fluids; and combination vapor-gas cycles. It appeared that the gas turbine cycles, utilizing the closed-cycle arrangement, were of especial importance from the viewpoint of compact, lightweight, high performance plants. (M.H.R.)

8066 KAPL-M-DOM-2
Knolls Atomic Power Lab., Schenectady, N. Y.
COMPARISON OF ONE, TWO, AND SIX GROUP REACTOR KINETICS COMPUTER MODELS. Daniel R. MacNaughton. Mar. 21, 1958. 12p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

Analog computer models of one, two, and six group reactor kinetics are compared. The two group model is shown to be adequate for use in over-all power plant transient studies. A convenient method of checking a kinetics model by the use of a ramp of neutron flux is presented. Curves showing the response of a power plant model to changes in steam demand are shown to illustrate the effects of one, two, and six group kinetics. (auth)

8067 KAPL-M-JRR-1
Knolls Atomic Power Lab., Schenectady, N. Y.
CALCULATION OF CORE SIZE FOR THE PRESSURIZED TEST REACTOR. J. R. Roesser. Mar. 17, 1958. 29p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The core widths were calculated for a 30 × 36 in. slab shape, water reflected, homogeneous, enriched U^{235}, zirconium-water reactor. This was done after calculating reflector savings for the following core conditions: four different fuel densities, three metal to water ratios, and three temperatures. The core widths of the proposed heterogeneous reactors were then calculated from the homogeneous results using a tabulation of self-shielding factors for these geometries prepared by M. Barten. (auth)

8068 KAPL-M-MLS-11
Knolls Atomic Power Lab., Schenectady, N. Y.
A NOTE ON THE TREATMENT OF THIN REGIONS IN MULTIGROUP CALCULATIONS. M. L. Storm. Mar. 10, 1958. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Current calculational techniques at KAPL for the explicit representation of thin regions (e.g., control rod blades) in multigroup calculations involve the mockup of the thin region by means of mesh points located on its surface, and the choice of effective cross sections. However, in many multigroup calculations, it is desirable to insert additional mesh points along the center line of a thin region in order that calculational advantage be taken of symmetries inherent in the reactor geometry. Let R_2 and T_2 be the reflection and transmission probabilities of the original thin region of thickness 2t and R_1 and T_1 the corresponding probabilities of the two thin regions of thickness t created by insertion of the mesh points. The choice $R_1 = R_2/1 + T_2$, $T_1^2 = T_2\{1-R_1^2\}$, insures the equivalence of both thin region representations in the multigroup calculations. The results of one-dimensional, three group, calculations illustrating the application of these formulas are also presented. (auth)

8069 KAPL-M-SMS-90
Knolls Atomic Power Lab., Schenectady, N. Y.
LOSS OF COOLANT ACCIDENT. W. W. Goodwin. Jan. 31, 1958. 28p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Events are studied which take place in the S3G and the S4G systems after a pipe break as a function of rupture size and location. The analysis shows what size rupture can be sustained without damage to the reactor core using a specified system for injecting makeup water to the primary coolant system. (W.D.M.)

8070 KAPL-M-SSD-22(Rev. 2)
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G/S4G REACTOR PLANT FRESH WATER COOLING SYSTEM DESIGN DESCRIPTION. G. H. Fautsch. Dec. 28, 1956. 53p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

8071 NAA-SR-1800
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ORGANIC MODERATED REACTOR EXPERIMENT QUARTERLY PROGRESS REPORT [FOR] AUGUST–OCTOBER 1956. C. A. Trilling, ed. Nov. 15, 1957. 102p. Contract AT(04-3)-88. $2.75(OTS).

The OMRE fuel element is composed of stainless steel clad UO_2–stainless steel plates assembled in a rectangular box. Progress in plate fabrication and element assembly are reviewed, and a new floating-plate element design is described. This new design has satisfactory heat-transfer characteristics and improved structural integrity. A systems analysis revealed a requirement for fast regulating control in addition to the combination of slow regulating and shim action originally contemplated. Tests indicated the hydraulically-driven, magnetically coupled system was not suited for fast control, therefore, engineering studies of an alternate electromechanical system were begun. A description of the proposed system is given. Calculated gamma flux levels in the neutron detector tubes indicate they may be sufficient to mask the detector signals, therefore, the instrument tubes were redesigned. The shielding requirements of the new tubes are given. Radiation levels around the reactor were calculated for full power, 16-Mw, operation. Site development and plant construction are reviewed. Site development is 80% complete; plant construction is 30% complete. Results from activation tests, heat transfer measurements, and physical property determinations on biphenyl and terphenyl are included. A diagram and a description of the coolant purification system are also given. (For preceding period see NAA-SR-1700.) (D.E.B.)

8072 NAA-SR-2224
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REACTOR SAFETY QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1957. Norman C. Miller. Mar. 15, 1958. 22p. Contract AT-11-1-GEN-8. $0.75(OTS).

A NAA-109-3 experimental assembly was inserted into a Hanford reactor. Pressure rise in the poison storage chamber was much higher than expected, and caused a failure in the system. Excessive gamma heating is pro-

posed as a plausible explanation. Results are tabulated for the lifetime testing of six rebuilt test elements of Mark II design. Experiments were conducted on dispersal of a powdered poison by a pressurized inert gas. The time and uniformity of powder distribution were studied. These experiments are connected with the power reactor safety device program. Test results are reported on an experimental model of the differential pressure device for power reactor safety, using an improved test apparatus. Progress is reported on the KEWB demonstration of the double-diaphragm and electronic-explosive systems which have been proposed for research reactor safety devices. (For preceding period see NAA-SR-2157.) (auth)

8073 NAA-SR-2463

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

HANFORD SAFETY DEVICE SUMMARY REPORT. Stephen H. Fitch. Apr. 1, 1958. 38p. Contract AT-11-1-GEN-8. $1.25(OTS).

The Hanford Safety Device Program was set up to study and test self-contained safety systems of high, inherent reliability, and to apply at least one of them to the Hanford reactors. A complete laboratory and in-pile test program was conducted on an experimental model which was designated Mark II. An extension of this design, designated Mark IV, has essentially the same features but is better suited to standard production fabrication techniques. Both designs feature a reactivity change which is effected by releasing an absorbent gas, boron trifluoride, from a small chamber into a larger chamber. When the flux exceeds a preset level, excessive heat generated in a U^{238} heater melts a fusible plug, and causes the release of the gas. The program has been completed with the design and testing of these and other safety systems which offer back-up protection for the Hanford reactors. (auth)

8074 NAA-SR-2476

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SAFETY DEVICE TESTS IN KEWB I. Charles C. Weeks and Stephen H. Fitch. Jan. 28, 1958. 23p. Contract AT-11-1-GEN-8. $0.75(OTS).

The feasibility of the electronic-explosive safety device was demonstrated in KEWB-I reactor excursions. It was shown to be a fast, efficient safety system for reactor protection. The safety devices inserted 1.5% negative reactivity into the core region of the KEWB-I reactor to produce rapid shutdown. The system response time, i.e., that time interval between trip and insertion times, was found to be 4.2 msec. The complete freedom in choice of trip level and the flexibility of device geometry makes the system applicable to many types of reactor and critical assembly. The system does not offer the ultimate in reactor safety because it is not completely self-contained, but it is a practical, workable system for reactor protection. (auth)

8075 NAA-SR-Memo-633

North American Aviation, Inc., [Downey, Calif.].

HETEROGENEOUS POWER REACTORS AND INTRINSIC SAFETY. J. E. Garvey. Apr. 10, 1953. Decl. Mar. 25, 1958. 27p. $4.80(ph OTS); $2.70(mf OTS).

An investigation is made into the possibility of securing "intrinsic" safety for heterogeneous power reactors, in particular, PPRE. Essentially, what is involved is replacing a cell of a normal reactor with a medium designed to introduce, upon the power and temperature rise following the initiation of a super-prompt-critical reactivity increment, a negative increment of reactivity sufficient to prevent fuel rod temperatures from reaching the melting point. Analyzed is the possible exploitation of the following phenomena: (α) increase of σ_{th} of certain nuclei with rising neutron temperature, (β) decrease in density of liquid fuels upon rising material temperature, (γ) dissociation in liquid fuel solutions, (δ) phase changes of liquid fuels, and (ϵ) fast effect reductions due to geometry changes in 25 fuel element configuration. A 2 rak runaway is analyzed for PPRE with a safety region operating on the principle of the α-phenomenon, the nucleus in question being Er. In general, it is concluded that for reactions of magnitude 1 to 1.5 rak any of the phenomena α, β, γ may be conveniently and practically exploited although for a power reactor a $\beta-\gamma$ combination appears preferable. For a 3 rak reaction either the γ, δ or ϵ type phenomena may be exploited, although from other considerations than effectiveness in halting the runaway, the γ type appears preferable. (auth)

8076 NP-6652

Reaktor AG, Wurenlingen, Switzerland.

CLOSED-CYCLE-GAS-TURBINE-REACTOR-POWER-PLANT. W. Winkler. Nov. 25, 1957. 15p.

A discussion of different problems involved with the development program of a closed-cycle-gas-turbine-reactor-power-plant is given. The types of enriched uranium fuel elements which permit an operation at temperatures of about 700°C, and some of the development work done in this field by private industry in the United States are discussed. Investigations on the choice of the gas from the nuclear and thermodynamic viewpoint are presented, and heat transfer and pressure loss problems for different gases and their mixtures are included. Calculations of gas activity due to neutron capture by the gas, impurities, residual matter from erosion or incomplete cleaning, and fission product leakage from the fuel elements are included. The thermal efficiency of different steam and gas cycles are also compared. (auth)

8077 PRDC-TR-4, PRDC-TR-5, and PRDC-TR-6

Power Reactor Development Co., Detroit.

MONTHLY TECHNICAL REPORTS: REPORT PERIOD, OCTOBER, NOVEMBER, DECEMBER 1957. (Oct., Dec. 18, 1957. 12p.; Nov. 10p.; and Dec. 12p.) Contract AT(11-1)-476. (PRDC-TR-4 and PRDC-TR-5, $3.30(ph OTS); $2.40(mf OTS) ea.; PRDC-TR-6, $4.80(ph OTS); $2.70(mf OTS).

These three reports were issued separately, but are cataloged as a unit.

Fermi Fast Breeder Reactor design and major component fabrication and procurement are reviewed. Brief statements on fuel pin testing are included. (For preceding period see AECU-3654.) (D.E.B.)

8078 PRDC-TR-7

Power Reactor Development Co., Detroit.

MONTHLY TECHNICAL REPORT: REPORT PERIOD, JANUARY 1958. 10p. Contract AT(11-1)-476. $1.80 (ph OTS); $1.80(mf OTS).

Fermi Fast Breeder Reactor design progress and major component fabrication status are summarized. (For preceding period see PRDC-6.) (D.E.B.)

8079 PRDC-TR-8

Power Reactor Development Co., Detroit.

MONTHLY TECHNICAL REPORT: REPORT PERIOD, FEBRUARY 1958. 15p. Contract AT(11-1)-476. $3.30 (ph OTS); $2.40(mf OTS).

Design data for the fuel element transfer cask are given. Design progress for the Fermi Fast Breeder Reactor is briefly summarized, and major component fabrication is reviewed. Results of fuel pin testing are discussed. (For preceding period see PRDC-7.) (D.E.B.)

8080 WAPD-ARS-(RD-2)
[Westinghouse Electric Corp.]. Atomic Power Div., Pittsburgh.
PRELIMINARY ESTIMATES OF THE THERMAL AND HYDRAULIC PERFORMANCE OF ADVANCED REACTOR CORES. Richard L. Ewen. Sept. 20, 1954. Changed from OFFICIAL USE ONLY Jan. 10, 1958. 30p. $4.80 (ph OTS); $2.70(mf OTS).

The equations used in advanced reactor core calculations and a semigraphical method for their solution are presented. The following fuel elements are analyzed: continuous plates, parallel-flow rods, cross-flow rods, tubular flow channels in a solid matrix of fuel, and pellets. (M.H.R.)

8081 WAPD-EM-83
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
BUCKLING TEST ON CORE SUBASSEMBLY SECTION—STRUCTURAL AND HEAT ENGINEERING. D. Burgreen. Mar. 9, 1951. Decl. Mar. 12, 1957. 10p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

A test was performed to determine the buckling strength of a typical core subassembly section. The appearance of the subassembly section before and after buckling is shown. The load was applied parallel to the fuel and end plates, uniformly distributed over the side plates. Bonded wire strain gages were attached to both sides of a fuel plate and end plate, at their midpoints, and the strains from these gages were used to determine the thrust and bending in these plates. The extreme fiber strain difference, representing the bending in the plates, is shown. This strain difference was used in determining the buckling load of the subassembly. A computation of the buckling load of a fuel plate or an end plate indicated that these plates behave as short columns and buckle in the plastic range. This was verified by the test. A buckling load of approximately 50,000 pounds or 25,000 per inch of length was recorded for the composite subassembly section. (auth)

8082 WAPD-IPC-395
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RESULTS OF X-3-e TEST SURFACE EXAMINATION. Kurt Katz. [Jan. 1957]. Decl. Jan. 12, 1958. 30p. $4.80 (ph OTS); $2.70(mf OTS).

Two possible detrimental effects of nucleate boiling heat transfer are described: increased insulation of heat transfer area by deposition and severe corrosion of the fuel element cladding. Samples of uranium with 10% niobium, and uranium with 12% molybdenum, both clad with Zircaloy, were tested. (J.R.D.)

8083 WAPD-MRP-58(Del.)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD OCTOBER 21 TO DECEMBER 1, 1955. Apr. 1956. Decl. Mar. 16, 1957. 90p. Contract AT-11-1-GEN-14. $2.25(OTS).

Power plant analysis, systems and components, materials, control and auxiliaries for PWR engineering and fuel elements, core metallurgy, chemistry of the in-pile loop, and reactor physics for PWR development are reported. (F.S.)

8084 WAPD-MRP-60
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD JANUARY 13, 1956 TO FEBRUARY 23, 1956. Changed from OFFICIAL USE ONLY Jan. 2, 1958. 95p. Contract AT-11-1-GEN-14. $2.25(OTS).

PWR Engineering. Reactor plant parameters are summarized. Calculations were completed of the pressures in the plant container resulting from a $Zr-H_2O$ reaction should a primary system rupture cause a core meltdown. Revisions in systems are briefly described. The progress of plant construction is illustrated. The steam generator heat exchangers are also illustrated. Reference designs are given for blanket assemblies and seed clusters. The final fuel rod and bundle designs are also shown. Reference designs for the Hf control rod and shroud are given. The amount of boric acid needed to achieve a safe cold subcritical condition with various numbers of rods stuck is tabulated. Reactor instrumentation location is shown. Blanket rod spacing limits are given, and blanket orifice regions are shown. A determination was made of the heat flux necessary to start melting in the center of UO_2 fuel rods. The reactor vessel assembly is shown. PWR Development. The fabrication of seamless tubes and fuel components are discussed. The effect of stress on the thermal stability of U–Mo alloys was studied. The thermal stability of U–Nb–Zr alloys was also studied. Some of the magnetic properties of uranium hydride are reported. Experiments performed on identification of the hydride phase formed during corrosion of γ phase Mo–U alloys are described. Information is given on the U–Nb phase diagram and on the structure and stability of UO_2. Measurements were made of in-pile fission gas release. Average flux values in half length reference rods are tabulated. Data are also reported on a full length defected UO_2 rod. Thermal cycling of Zircaloy-2 clad UO_2 rods is also reported. Radiation-corrosion tests were made on U–Nb and U–Mo alloys. The fabrication of U–Si alloys with a cast Al barrier layer was continued. Corrosion data are also given on U–Si systems. Corrosion tests were continued on Al-base alloys for cladding applications. The surface area and density of UO_2 powders are reported. Studies of the effects of C and Si impurities on the corrosion behavior of sintered UO_2 compacts were continued. Factors affecting the sinterability of UO_2 were studied. The stability of UO_2 in H_2O was also studied. In-pile tests fuel materials are summarized. Fission product removal processes are discussed. The adsorption of coolant activity on particulate matter in water suspension is discussed. Instruments for the continuous analysis of the coolant are described. Decontamination and waste disposal procedures are also described. Analyses of reactor core structures were continued. Shielding calculations were made. Neutron flux distributions in UO_2 rod lattices are tabulated. Reactivity gain experiments were conducted. (D.E.B.)

8085 WAPD-PWR-PA-1060(Issue 3)
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
LIST OF OPERATIONAL LIMITATIONS, PRECAUTIONS, AND SET POINTS. Mar. 7, 1958. 62p. $10.80(ph OTS); $3.90(mf OTS).

Lists are presented which were prepared to insure safe operation of the Shippingport Pressurized Water Reactor. Precautions and limitations are given to prevent inadvertent plant shutdown, damage to equipment, and hazards to personnel. (D.E.B.)

8086 WAPD-PWR-PS-2672(Rev.)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
GAMMA RADIATION LEVELS FROM DEPOSITED FISSION PRODUCTS IN THE PRIMARY SYSTEM. R. F. Devine. Jan. 23, 1957. 5p. Contract AT-11-1-GEN-14. $1.80 (ph OTS); $1.80(mf OTS).

The discussion is based on the estimate that the level of fission product activity deposited on the inside walls of the reactor vessel and on other piping and vessels with no decontamination will not exceed a maximum of 1×10^9 Mev/sec-cm^2. An estimate of the dose rate on contact with

certain specified primary system components which would result from a range of deposited activity from 1×10^6 Mev/sec-cm^2 to 1×10^8 Mev/sec-cm^2 is included. (M.H.R.)

8087 WAPD-ReC(A)-4

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

LOW PRESSURE CONTROL ROD. A. M. Poindexter. Aug. 24, 1953. Decl. Apr. 12, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

A way of using control rods in pellet reactors which seems to have considerable promise is reported. The method referred to is as follows: The control rods operate in pressure tight stainless steel thimbles which would be part of the pressure vessel. A separate supply of low-pressure coolant is circulated around the rods to cool them. The stem which fastens to the operating mechanism comes out of the rod coolant housing through a gland arrangement. This seals in the low pressure coolant and allows the operating mechanism to be located in air, and if desired, outside the shielded space. (auth)

8088 WASH-747

Ballistic Research Labs., Aberdeen Proving Ground, Md.

MEASUREMENT OF AIR BLAST EFFECTS FROM SIMULATED NUCLEAR REACTOR CORE EXCURSIONS. Richard J. Larson and Wendell C. Olson. Sept. 1957. 41p. Sponsored by AEC under DA Project No. 5B03-04-002. (BRL-Memo-1102). $1.25(OTS).

Tests were conducted to evaluate methods of simulating on a small scale, the effect of nuclear reactor "runaway" on a containment shell surrounding the reactor. Reactor core vessels, simulated by small pressure tanks, were burst by chemical reactions of various rates, and the resulting pressure-time histories were recorded by piezoelectric air blast gages placed at various distances from the core. Results of 150 observations are tabulated and presented graphically. The test results were compared with existing blast data for chemical explosives and also with Brode's theoretical analysis of spherical blast waves. The use of an explosive, which provided the fastest reactive rate, proved to be the most practical means of simulating reactor core runaway. (auth)

8089 WCAP-667

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. [Atomic Power Dept.], Pittsburgh.

PROPOSED METHOD OF TWO-PHASE PRESSURE DROP CALCULATION FOR THE DESIGN OF THE PAR EMERGENCY DRAIN PIPING. H. J. Cordle and W. P. Haass. Sept. 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

During an emergency fuel dump from the Pennsylvania Advanced Reactor, the slurry will flash into a vapor-liquid mixture. Design calculations for the emergency drain system will thus require a calculational method for two-phase flow and pressure drop. A literature survey revealed two such methods, a homogeneous method and the Martinelli method. These two methods are described and discussed. The homogeneous method appears most promising for PAR conditions. (D.E.B.)

8090 YAEC-6(Rev.)

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

REACTOR CORE COMPARISONS. E. A. McCabe, Jr., V. E. Grob, and G. M. Inman, eds. Aug. 1, 1957. 27p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $4.80(ph OTS); $2.70(mf OTS).

A core design study based upon the Yankee "Reference Design" as given in YAEC-1 was performed. This study covered five basic core designs, each analyzed with three sets of hot channel factors. Based on the results of this study, a "Compromise Core" design was developed. After completion of the above 16 core analyses, a review of the study was conducted. During this review new empirical data on the thermal conductivity of UO_2 became available, and it was apparent that yet another core design designated as "Nominal Design-First Core" was required based on a new and lower value of thermal conductivity. Thus, this study covers 17 different cases. The pertinent nuclear, thermal, and mechanical data are presented for the 17 cases, representing the five basic designs each analyzed with three sets of hot channel factors, a "Compromise Core," and the "Nominal Design-First Core." Fuel cost data are presented for 10 cores from the first 15 analyzed and for the "Compromise Core," and finally, for the "Nominal Design-First Core." The significance of the old and new values of conductivity of UO_2 are discussed. (auth)

8091 YAEC-55

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MONTHLY PROGRESS REPORT FOR THE PERIOD FEBRUARY 1 TO 28, 1958. I. H. Coen and R. W. Garbe. Mar. 20, 1958. 14p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

Progress in the design and development of the Yankee Power Reactor and its components is briefly reviewed. (For preceding period see YAEC-54.) (D.E.B.)

8092 YAEC-57

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

ANALYSIS OF EXPERIMENTAL DATA ON REACTIVITY OF PLUTONIUM-BEARING FUEL RODS. W. H. Arnold, Jr. Feb. 25, 1958. 19p. For Yankee Atomic Electric Co. Contract AT(30-3-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

A series of experiments were performed to determine the criticality of depleted uranium fuel rods containing 1% Pu. The data were analyzed and the results compared with hand calculations. Hand calculations gave quite good agreement with experiment, thus lending a degree of confidence to the predictions of the reactivity effects of plutonium in the first core of the Yankee Atomic Electric Company reactor. (auth)

8093

APPLICATION OF ORGANIC COMPOUNDS IN REACTOR CONSTRUCTION. I. S. (S. I.). Atomnaya Energiya 3, No. 10, 364-7(1957).

The application of organic heat carriers in reactors offers the following advantages: high temperatures at low values of pressure are easily obtainable; the neutron capture cross sections are low and thus there is little activity; erosion and corrosion phenomena on working materials are limited by organic means. Tabularly the following details are given: melting and boiling temperature, steam pressure, density, viscosity, thermal conductivity, content on hydrogen, etc. Graphically, the polymerization effect is shown on meta-, para-, and ortho-terphenyl at 400 and 450°C in dependence on the irradiation dose. (TCO)

8094

NONDESTRUCTIVE TESTING OF FUEL ELEMENTS FOR DIDO. J. Thewlis and R. T. P. Derbyshire (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Soc. Non-Destructive Testing 16, 154-7(1958) Mar.-Apr.

A description is given of the methods employed in the nondestructive testing of DIDO fuel plates for bonding, homogeneity, and size and location of core. The main part

of the paper is devoted to the description of an x-ray fluoroscopic apparatus by the use of which the size and location of the fuel core can be rapidly and easily determined by semiskilled labor. The size is checked by referring the projected x-ray image of the core to the image of gauge-wires projected on a fluorescent screen equipped with suitable scales, and the position of the core is also established with respect to these. Locating holes are punched when the fuel core is correctly positioned. The holes then serve to locate the fuel plate in a cropping machine which trims off the surplus sheath metal. After brief instruction it is possible for operators to deal with some twenty fuel plates per hour. Optical fatigue is reduced to a minimum by the provision of high contrast and brightness; radiography has confirmed that the cores are satisfactorily located for cropping and that the required limits of tolerance, (±0.02 inch) can be maintained. (auth)

8095

NRU—SOME OF ITS SPECIAL TESTING PROBLEMS. A. J. Mooradian (Atomic Energy of Canada, Ltd., Chalk River, Ont.). J. Soc. Non-Destructive Testing 16, 164-70 (1958) Mar.-Apr.

Some of the major components of the NRU Reactor and some of the special testing techniques which have been developed for the inspection of its fuel elements are discussed. (J.E.D.)

8096

PLUTO, MEASUREMENT AND CONTROL. Nuclear Eng. 3, 141-54(1958) Apr.

Basic principle and scope of the instrumentation which a research reactor requires are considered. An outline of the nuclear instrumentation of Pluto and a description of the apparatus and operation of the monitors necessary for safety protection and health precautions are presented. The principles of the "2 out of 3" system is employed to insure absolute safety in operation without false tripping. The physical instrumentation required for the cooling and heating circuits is discussed. (W.D.M.)

8097

POWER REACTOR INSTRUMENTATION. R. J. Smith (General Electric Co., Ltd.). Nuclear Eng. 3, 155-7 (1958) Apr.

This is an evaluation of the instrumentation needs of power stations, compared with research reactors, together with a short discussion on the overall control of electrical, steam, and reactor sections for station loading. A schedule shows the important measuring points and the physical location of the instruments. (auth)

8098

GAS MONITORING EQUIPMENT FOR BERKELEY POWER STATION. F. Harlen (Dowty Nucleonics, Ltd.). Nuclear Eng. 3, 158-62(1958) Apr.

The gas monitoring equipment to detect faulty fuel elements for the Berkeley power station is described and compared to the Calder Hall equipment. A discussion of future developments in gas monitoring equipment is presented. (W.D.M.)

8099

THE AG REACTOR—A NATIONAL BUSINESS. R. Sontheim. Reaktor Bull. No. 4, 3-5(1958) Feb. (In German)

The Swiss research reactor (the AG) was constructed through the financial cooperation of over 160 private concerns from industry, electric power companies, banks, and insurance companies. A list of the supporters is given. (J.S.R.)

8100

THE PROGRAM OF THE AG REACTOR. W. Zünti. Reaktor Bull. No. 4, 6-7(1958) Feb. (In German)

The research program planned for the Swiss AG reactor is briefly outlined. (J.S.R.)

8101

THE DESIGN OF THE BUILDINGS OF THE AG REACTOR. W. Winkler. Reaktor Bull. No. 4, 7-15(1958) Feb. (In German)

Sketches and pictures of the layout of the buildings for the Swiss AG reactor are given. (J.S.R.)

8102

THE LABORATORY BUILDING WITH RESEARCH FACILITIES. K. Metzger. Reaktor Bull. No. 4, 15-17(1958) Feb. (In German)

A sketch of the laboratory building with its research facilities for the Swiss AG reactor is given. (J.S.R.)

8103

THE DIORIT RESEARCH REACTOR. A. F. Fritzsche. Reaktor Bull. No. 4, 17-24(1958) Feb. (In German)

The DIORIT, a proposed Swiss research reactor, is designed as a thermal heterogeneous reactor, using natural uranium as fuel and heavy water as moderater and coolant. Detailed sketches are given. (J.S.R.)

8104

THE INSTRUMENTATION OF THE DIORIT. J. Ottrubay. Reaktor Bull. No. 4, 24-5(1958) Feb. (In German)

8105

THE CONTROL OF A HEAVY WATER REACTOR. H. G. Meyer. Reaktor Bull. No. 4, 26-9(1958) Feb. (In German)

A generalized survey of the problems of control of a heavy water reactor is given. (J.S.R.)

8106

THE CONTROL OF THE POWER PLANT OF THE DIORIT. H. Becker. Reaktor Bull. No. 4, 29-32(1958) Feb. (In German)

8107

THE ENERGY SUPPLY OF THE DIORIT. B. Steiner. Reaktor Bull. No. 4, 33-5(1958) Feb. (In German)

Nuclear Transformation

8108

THE ANGULAR DISTRIBUTIONS OF LIGHT AND HEAVY FRAGMENTS FROM THE 14 Mev NEUTRON FISSION OF U^{238}. A. N. Protopopov and V. P. Eismont. Atomnaya Energiya 4, 194-5(1958). (In Russian)

A method is offered for the comparison of the distribution of light and heavy fragments in the direction parallel to the motion of the incident neutrons. Simultaneous measurements were made of the angular distribution of the fragment to the beam of excitation particles and of the kinetic energy of extra fragments emitted at the similar angle. According to the pulse conservation law the ratio of fragment energies (in the center of gravity) is equal to the inverse ratio of their mass; the relative number of these relations determines the mass distribution of fission fragments in a given direction. A dual ionization chamber with protective grid was used for the determination of energies of the fragments. Results indicated that within the limits of statistical error (5%) the emission at 0° to 180° are equally probable, hence the angular distribution of light and heavy fragments is symmetric at 90°. It is also shown that in U^{238} fission induced by 14 Mev neutrons the angular anisotropy increases with the increase of the mass ratio of fragments. (R.V.J.)

8109

RARE-EARTH YIELDS IN THE 660 Mev PROTON SPALLATION OF Bi. A. V. Kalyamin, A. N. Murin, B. K.

Preobrazhenskii, and N. E. Titov. Atomnaya Energiya 4, 196-7(1958). (In Russian)

Cross sections of the spallation yields from Z-84 (polonium) to Z-58 (cerium), with mass number changes from 209 (the target) to 134, were examined. A diagram of partial cross sections for nuclear products produced by cascade-nuclear process is included. (R.V.J.)

8110

HALF-LIFE AND FISSION YIELD OF Sr^{90} FROM U^{233}. M. P. Anikina, R. N. Ivanov, G. M. Kukavadze, and B. V. Ershler. Atomnaya Energiya 4, 198(1958). (In Russian)

8111

INVESTIGATION OF THE $B^{10}(n, \alpha)Li^7$ REACTION BY THE PHOTOEMULSION METHOD. E. Bujdosó (Inst. of Nuclear Research of the Hungarian Academy of Sciences, Debrecen, Hungary). Nuclear Phys. 6, 107-13(1958) Mar. (2).

Nuclear emulsion Agfa K3 (loaded with boron) was exposed to slow neutrons. By measuring the range $R(\alpha + Li^7)$, the values $Q^* = 2.29 \pm 0.09$ Mev and $Q = 2.76 \pm 0.17$ Mev were obtained for the energy of the reaction. The ratio of decays leading to the ground and excited states of the Li^7 nucleus is $\sigma[B^{10}(n, \alpha)Li^7]/\sigma[B^{10}(n, \alpha)Li^{7*}] = 0.086 \pm 0.009$. (auth)

8112

THE PROTONS EMITTED FROM IRON-54 AND IRON-56 ON BOMBARDMENT WITH 13.5 Mev NEUTRONS. P. V. March and W. T. Morton (Univ. of Glasgow). Phil. Mag. (8) 3, 143-51(1958) Feb.

Energy spectra and angular distributions of protons emitted from the isotopes Fe^{54} and Fe^{56} on bombardment with neutrons with an energy of 13.5 Mev have been studied using photographic emulsions. The angular distributions of protons with energy greater than 7 Mev show a marked forward peak suggesting the occurrence of direct interaction. (auth)

8113

PARITY CONSERVATION IN STRONG INTERACTIONS: THE $^7Be(n,\alpha)^4He$ REACTION. R. E. Segel (Aeronautical Research Lab., WADC), J. V. Kane (Brookhaven National Lab., Upton, N. Y.), and D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y. and Clarendon Lab., Oxford). Phil. Mag. (8) 3, 204-7(1958) Feb.

The abundance of evidence for lack of conservation of parity in weak interactions raises the question as to whether parity is conserved in strong interactions. The spin of the Be^7 nucleus is $^3/_2$ and the parity odd. Since the centrifugal barrier inhibits thermal neutron interactions with orbital angular momentum greater than zero, the parity of the initial system formed by the absorption of a thermal neutron must be odd. The symmetry and parity operators are identical for identical, spinless particles and so a Be^8 state of odd parity cannot break up into two alpha particles if parity is conserved. The Q value of the $Be^7(n,\gamma)He^4$ reaction (from the known masses) is 18.98 Mev. The disintegration of Be^7 by slow neutrons into two 9.5 Mev alpha particles was therefore sought as an indication of violation of parity conservation. An upper limit of 25 mb was set for the (n,α) cross section. An upper limit of 1×10^{-7} is also set for the square of the amplitude of the parity non-conserving component of the wave function. The results are not sensitive to whether the parity non-conserving forces conserve isotopic spin. (A.C.)

8114

PARITY CONSERVATION IN STRONG INTERACTIONS: INTRODUCTION AND THE REACTION $He^4(d,\gamma)Li^6$. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y. and Clarendon Lab., Oxford, Eng.). Phys. Rev. 109, 1603-9 (1958) Mar. 1.

A discussion is made of the ways in which parity conservation in ordinary strongly interacting nuclear systems might be investigated. Three classes of experiment are proposed: in class I violations of absolute selection rules based on strict parity conservation and sensitive to $\mathfrak{I}^2$, the intensity of the irregular or parity-nonconserving part of the wave functions; in class II longitudinal polarization of product heavy particles or circular polarization of gamma rays from initially unpolarized systems and sensitive directly to $\mathfrak{I}$; in class III odd powers of $\cos\theta$ in the angular distributions or correlations of radiations emitted from well-isolated nuclear states and again sensitive to $\mathfrak{I}^2$. An experiment of class I is presented, namely a search for the radiative capture $He^4(d,\gamma)Li^6$ through the 0+ state at 3.56 Mev. It is concluded that the heavy-particle width of this state is zero within a standard deviation of 0.2 ev and that this corresponds to $\mathfrak{I}^2 \lesssim 1 \times 10^{-7}$. (auth)

8115

PARITY CONSERVATION IN STRONG INTERACTIONS: REACTIONS $B^{11}(p,p')B^{11*}$ and $F^{19}(p,\alpha)O^{16*}$. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y. and Clarendon Lab., Oxford, Eng.). Phys. Rev. 109, 1610-13(1958) Mar. 1.

If parity is strictly conserved, the gamma rays emitted following the bombardment of unpolarized target nuclei by unpolarized projectiles can show no circular polarization. We look for such polarization, using an analyzer of magnetized iron, in the 2.14-Mev gamma ray from the first excited state of B^{11} formed by $B^{11}(p,p')B^{11*}$ and in the 7.12-Mev gamma ray from the fourth excited state of O^{16} formed in $F^{19}(p,\alpha)O^{16*}$. We expect this polarization to be of order $\Re\mathfrak{I}$, where $\mathfrak{I}$ is the amplitude of the parity-nonconserving part of the relevant wave functions and $\Re$ is a matrix element factor. We find that the intensity of circular polarization in the first case is less than 2.0×10^{-3} and in the second case 2.0×10^{-3}. These figures yield $\mathfrak{I}^2 \lesssim 1 \times 10^{-7}$ and $\mathfrak{I}^2 \lesssim 3 \times 10^{-6}$, respectively. (auth)

8116

PARITY CONSERVATION IN STRONG INTERACTIONS: REACTION $Li^7(p,p')Li^{7*}$. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y. and Clarendon Lab., Oxford, Eng.). Phys. Rev. 109, 1614-19(1958) Mar. 1.

Unless parity conservation breaks down in strong interactions the radiations emitted from an isolated level cannot display odd powers of $\cos\theta$ in their angular distribution or correlation. A search for such powers is then an approach to the conservation problem. The $^1/_2$-first excited state of Li^7 at 477 kev has been excited by inelastic proton scattering. The expected angular distribution of the gamma rays of de-excitation relative to the bombarding proton beam is $1 + \alpha\cos\theta$ where α is of the order $\Re\mathfrak{I}^2$, $\mathfrak{I}$ being the amplitude of of the parity nonconserving part of the relevant wave functions and $\Re$ is a matrix element factor. By comparison with the radiation following K capture in Be^7 it is shown that α is zero within a standard deviation of 6 parts in 10^4. This corresponds to $\mathfrak{I}^2 \lesssim 1 \times 10^{-4}$. (auth)

8117

ANGULAR DISTRIBUTIONS OF THE $B^{11}(d,n)C^{12*}$ FIRST EXCITED STATE NEUTRONS. Oakes Ames and George E. Owen (Johns Hopkins Univ., Baltimore). Phys. Rev. 109, 1639-41(1958) Mar. 1.

The angular distributions of the first excited state neutrons from the reaction $B^{11}(d,n)C^{12}$ have been measured at deuteron bombarding energies of 0.6 and 1.0 Mev, using a single stilbene crystal counter. The distributions are asymmetric about the 90° direction, showing an excess in the forward direction. The data are consistent with an analysis based on nuclear stripping theory. Total cross sections were obtained at 0.6, 0.8, and 1.0 Mev. (auth)

8118

ENERGY DEPENDENCE OF F^{19} + p REACTIONS. W. A. Ranken, T. W. Bonner, and J. H. McCrary (Rice Inst., Houston, Texas). Phys. Rev. 109, 1646-51(1958) Mar. 1.

Excitation functions have been obtained for the $F^{19}(p,\alpha\pi)O^{16}$, $F^{19}(p,\alpha_0)O^{16}$, $F^{19}(p,\alpha\gamma)O^{16}$, and $F^{19}(p,p'\gamma)F^{19}$ reactions for proton energies of 1.2 to 5.4 Mev. The marked similarity of the pair and long-range alpha excitation functions is noted and in the proton energy interval 1.35 to 2.33 Mev the differences between the yields are explained by the penetration factors for alpha particles emitted from the excited states of Ne^{20}. The average reaction cross section has been obtained for the F^{19} + p reactions by averaging the excitation functions over one-half Mev intervals. The result is compared to the cross section given by the continuum theory. (auth)

8119

ANGULAR DISTRIBUTIONS FROM DEUTERON-INDUCED REACTIONS IN SODIUM. W. F. Vogelsang and J. N. McGruer (Univ. of Pittsburgh). Phys. Rev. 109, 1663-8 (1958) Mar. 1.

Angular distributions and absolute cross sections were obtained for a group of reactions induced by 14.8-Mev deuteron bombardment of Na^{23}. The ground state and the 1.341-Mev state of the $Na^{23}(d,p)Na^{24}$ reaction were fitted with Butler curves of $l_n = 2$ and 0, respectively. The angular distributions of seven levels of the reaction $Na^{23}(d,d')Na^{23}$ were obtained. The Q values of these levels were measured to be −0.441, −2.073, −2.400, −2.689, −2.997, −3.689, −3.925, and −4.457 Mev all with an uncertainty of ±0.040 Mev. The ground state and the first three excited states of Na^{22} were observed by the reaction $Na^{23}(d,t)Na^{22}$. It was possible to fit the angular distributions to all the Na^{22} states with $l_n = 2$. The Q value of the $Na^{23}(d,t)Na^{22}$ ground state was measured to be Q = −6.211 ± 0.040 Mev. (auth)

8120

1.7-Mev STATE IN Be^9. Dan W. Miller (Indiana Univ., Bloomington). Phys. Rev. 109, 1669-74(1958) Mar. 1.

Evidence is presented concerning the 1.7-Mev state in Be^9 and its characteristics, which are currently in doubt because of the extreme weakness of the anomaly observed in charged-particle reactions. On the basis of this evidence, the state now appears to be well established, and its spin and parity are probably $\frac{1}{2}^+$ or $\frac{1}{2}^-$. The evidence in favor of the $\frac{1}{2}^+$ assignment, corresponding to an intermediate-coupling parameter α/K of ~ 2.75 for Be^9, comes from the final-state-interaction analysis in the present paper of the results of three different charged-particle reactions at Indiana University and the Massachusetts Institute of Technology, from the agreement between the scattering length for neutrons on Be^8 resulting from this analysis and the predictions of Ford and Bohm, and from the continuity of α/K with mass number. In addition, experiments on the mirror nucleus B^9 by Marion et al. seem to be in disagreement with the existence of a $\frac{1}{2}^-$ state in this region. The evidence in favor of the $\frac{1}{2}^-$ assignment, corresponding to $\alpha/K \sim 1.5$, comes from the static magnetic moment of Be^9 and the photodisintegration data of Connors and Miller. (auth)

8121

FISSION OF URANIUM, SILVER, AND BROMINE NUCLEI WITH HIGH-ENERGY PARTICLES. G. F. Denisenko, N. S. Ivanova, N. R. Novikova, N. A. Perfilov, E. I. Prokoeffieva, and V. P. Shamov (Academy of Sciences, Leningrad). Phys. Rev. 109, 1779-84(1958) Mar. 1.

New data are presented on the high-energy fragmentation and fission of U, Ag, and Br in nuclear emulsions. The method of investigation is described. The nature of triple-pronged events involving fission of U with 560 to 660 Mev protons is discussed. Data are given concerning fission of U with 300-Mev π^+ mesons. The cross section for the fission of Ag with high-energy protons is determined. (auth)

8122

THE DIFFERENTIAL CROSS SECTIONS FOR THE REACTIONS $^{14}N(d,p)^{15}N$ AND $^{14}N(d,\alpha)^{12}C$ BETWEEN 600 AND 1000 kev. D. L. Booth, F. V. Price, D. Roaf, and G. L. Salmon (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 71, 325-9(1958) Mar.

Using a thin gas target, the differential cross sections for the two most energetic proton and alpha groups have been measured; an expansion in the form $\Sigma a_n P_n(\cos\theta)$ has been fitted to the results. In no case was the value of a_n significant for $n > 3$, indicating that deuteron stripping is not important below 1-Mev bombarding energy. (auth)

8123

PHOTODISINTEGRATION OF SODIUM BY $^7Li(p,\gamma)$ RADIATION. T. R. Ophel and I. F. Wright (Australian National Univ., Canberra). Proc. Phys. Soc. (London) 71, 389-97 (1958) Mar.

A small thin NaI(Tl) scintillator has been used as both source and detector of photoprotons produced in sodium by $Li^7(p,\gamma)$ radiation. This technique provides photoproton energy spectra of good resolution and high statistical precision. Spectra were obtained with both resonance and non-resonance radiation from the $Li^7(p,\gamma)$ reaction which permit identification of protons produced by the 17.6 Mev component of the incident radiation. These protons correspond to transitions to states in Ne^{22} at energies of 0 (0.31 mb), 1.3 (2.5 mb), 3.3 (0.6 mb), 4.4 (0.9 mb), 5.4 and 5.7 Mev (approximately 2 mb for both). This experiment establishes the existence of Ne^{22} levels at the three highest energies. Previous evidence for a level between 4 and 5 Mev is discussed and is found to be compatible with the present results. (auth)

8124

NUCLEON POLARIZATION IN STRIPPING REACTIONS. Hans-Arwed Weidenmüller (Univ. of Heidelberg, Germany). Z. Physik 150, 389-406(1958). (In German)

From the general matrix elements for stripping reactions the influence of the tensor force of deuterons and the deviation from pure j-j coupling for singly bound nucleons on the polarization of liberated nucleons was investigated. The polarization was determined by the phase of the elastic scattering of deuterons and free nucleons at the target or terminal nucleus. The influence of this scattering phase on the polarization was numerically investigated. The sign of the polarization given for small angles is positive or negative when the spin $\frac{1}{2}$ and the angular momentum orbit l of the bound nucleons is coupled to $j = l - \frac{1}{2}$ or $j = l + \frac{1}{2}$. (tr-auth)

8125

ANGULAR AND ENERGY DISTRIBUTION OF PHOTOPROTONS FROM THE REACTION $Ar^{40}(\gamma,p)Cl^{39*}$. F. Gudden and J. Eichler (Univ. of Heidelberg, Germany). Z. Physik 150, 436-46(1958). (In German)

With γ radiation from a 15-Mev betatron the process $Ar^{40}(\gamma,p)Cl^{39}$ was investigated near the threshold with a Wilson chamber. For the energy and angular distribution 597 and 1218 proton traces, respectively, were measured. The energy distribution shows a maximum at 0.71 and 9.84 Mev. The angular distribution is almost a pure $\sin^2\theta$ distribution. These results are discussed with respect to the compound nucleus concept and the Courant theory of direct photoeffects. The process probably leads to an excited state of Cl^{39} at 9.8 Mev with spin $\frac{1}{2}$. (tr-auth)

8126

RELATIVE MEASUREMENT OF INTEGRATED EFFECTIVE CROSS SECTION FOR THE NUCLEAR PHOTOEFFECT: THE REACTION $Ca^{44}(\gamma,p)K^{43}$. P. Brix, U. Hegel, K. H. Lindenberger, and D. Quitmann (Univ. of Heidelberg, Germany). Z. Physik 150, 461-73(1958). (In German)

The K^{43} formed from Ca^{44} in the irradiation of Ca with bremsstrahlung from a betatron was identified. From a relativity measurement against the well known $C^{12}(\gamma,n)$ reaction the effective cross section, integrated to 31 Mev, was found to be 125 ± 25 Mev mb. The evaluation is dependent on the production of a differential spectrum for which, in the given energy range, the number of γ quanta is constant for every energy interval from the spectra of the betatron radiation filtered and non-filtered through 18 mm of lead. By linear combinations with other constants, the spectra, which are proportional to $1/E$ or $1/E^2$, approximate each other. These are shown for relativity measurements of the integral above σ/E and σ/E^2. (tr-auth)

Particle Accelerators

8127

ELECTRICAL AND MAGNETIC FIELDS WITH STRONG FOCUSSING IN APPLICATION TO THE HIGH ENERGY ACCELERATIONS. N. Martalogu. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 70-83(1957). (In Romanian)

After a review of methods of strong focusing, the application of strong focusing to accelerators is discussed. Various accelerators with alternant gradients are briefly shown. (J.S.R.)

8128

HISTORY OF CYCLOTRON DEVELOPMENT. L. M. Nemenov. Atomnaya Energiya 4, 117-27(1958). (In Russian)

A short review is given on the development of cyclotrons, and characteristics of cyclotron parameters are described. (tr-auth)

8129

THE ATTAINABLE FREQUENCY RATIO IN SYNCHROTRONS. E. M. Moroz and M. S. Rabinovich. Atomnaya Energiya 4, 128-31(1958). (In Russian)

The energy dependence of synchrotron oscillation amplitudes produced by radiation fluctuations was investigated. A solution for the steady-state phase equation was derived which can be applied, with satisfactory accuracy, to all large synchrotrons. It is shown that with acceleration of electrons up to several Bev the magnitude of the maximum attainable frequency ratio is strongly limited and is determined by the ultimate amplitude of the acceleration intensity. (tr-auth)

8130

HIGH-VOLTAGE SOURCES FOR SINGLE-SHOT STRONG-FOCUSING ACCELERATORS. B. S. Novikovskii. Atomnaya Energiya 4, 175-8(1958). (In Russian)

8131

ON A NEW TYPE OF LINEAR ACCELERATOR OF ELECTRONS WITH HIGH FREQUENCY GENERATOR INCORPORATED. Henri Leboutet, Germaine Vincent, and Rose Warnecke. Compt. rend. 246, 1519-22(1958) Mar. 10. (In French)

Data are given on the principle of a new type of accelerator with a high-frequency generator incorporated. A detailed description of the apparatus is presented. (J.S.R.)

8132

DEUTERON ACCELERATOR WITH VERY LOW PRESSURE. R. Bilwes, R. Seltz, M. Suffert, M. Liess, J. J. Nehlig, and D. Magnac-Valette (Laboratoire de Physique Corpusculaire de la Faculté des Sciences de Strasbourg, France). J. phys. radium 19, 183-4(1958) Feb. (In French)

The design and construction of a deuteron accelerator to be used for the measurement of deuteron cross sections at very low energies (0 to 40 kev) in the study of thermonuclear reactions are discussed. (J.S.R.)

8133

RADIO FREQUENCY TRANSMISSION SYSTEM A 30 Mev ELECTRON CYCLOTRON. M. Innas Ali (Dacca Univ., East Pakistan). Pakistan J. Sci. and Industrial Research 1, 26-36(1958) Jan.

The principle of magnetic resonance, upon which the operation of a magnetic cyclotron depends, consists of a resonance cavity situated in a uniform magnetic field. The cavity is energized by a pulsed magnetron. An efficient radiofrequency transmission system is described for feeding power stably from the magnetron to the cavity resonator. Methods of magnetron stabilization are discussed. (J.R.D.)

8134

METHOD FOR DAMPING PHASE OSCILLATIONS IN A SYNCHROTRON. Edwin J. Rogers (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 29, 215-17(1958) Mar.

A phase oscillation damping system has been developed and successfully tested at the Brookhaven cosmotron. Phase differences between the induced voltage in the beam pickup plates and the rf accelerating voltage are detected and fed back to the frequency control system. The frequency of the rf accelerating voltage is thus adjusted to provide a phase restoring force. The usual 50% beam loss during the accelerating cycle is estimated and tests indicate that the beam stability with respect to disturbances in field vs. frequency characteristic is improved by a factor of five. (auth)

Radiation Absorption and Scattering

Refer also to abstract 7968.

8135

THE GAMMA-RAY SPECTRA PRODUCED BY INELASTIC FAST NEUTRON SCATTERING IN Mg, Al, Fe, Cu, Sn, AND Sb. I. F. Barchuk, M. V. Pasechnik, and Iu. A. Tsybulko. Atomnaya Energiya 4, 132-7(1958). (In Russian)

Measurements were made of γ-ray spectra in Mg, Al, Fe, Cu, Sn, and Sb produced by inelastic neutron scattering at 2.8 Mev. The measurements were carried out with a scintillation spectrometer with NaI crystal detector, photoelectron multiplier, and 50 channel pulse analyzer with a magnetic drum recorder. The spectrometer resolution was 6.5 to 7% for the Co^{60} γ ray. The γ-ray energies were found (in Mev) for magnesium, 0.97, 1.41, 1.92, 2.3; for aluminum, 0.84, 1.00, 1.80, 2.16; for iron, 0.84, 1.25, 1.46, 1.70; for copper, 0.63, 0.78, 0.96, 1.12, 1.38, 1.46, 1.72, 2.03; for tin, 0.84, 1.16, 1.50, 1.80, 2.16; and for antimony, 1.04, 1.50, 1.84, 2.16. (tr-auth)

8136

A CALCULATION OF THE ELASTIC NEUTRON SCATTERING IN CYLINDRICAL CONTROL ELEMENTS. T. Kh. Sedelnikov. Atomnaya Energiya 4, 192-4(1958). (In Russian)

Calculations were made of the elastic neutron scattering

in control rods. Generally the control rod elements are poor attenuators and their cross sections depend very little on the neutron energies; hence the problem can be accepted as a monoenergetic problem. A direct solution is offered by using the equation developed by B. A. Ambartsumyan et al. (Teoret. Astrofizika, State Pub. House, Moscow, (1952)) which associates the emitting radiation with the incident radiation. (R.V.J.)

8137

GAMMA-RAY BACK-SCATTERING FROM Al. V. A. Vasilev and V. A. Shishkina. Atomnaya Energiya 4, 205-6 (1958). (In Russian)

8138

ON THE SCATTERING OF K MESONS BY COMPLEX NUCLEI. P. Mittelstaedt (Max-Planck-Institut für Physik, Göttingen, Germany). Nuclear Phys. 6, 50-4(1958) Mar. (2). (In German)

The investigations of the K^--meson-nucleus scattering by means of the optical model have shown that the imaginary part of the optical potential is very large while the real part almost vanishes. Here it is shown that the vanishing of the real part of the optical potential results from the strong absorption of K^--mesons in the K^--nucleon scattering process. (auth)

8139

ANGULAR DISTRIBUTIONS OF ELASTICALLY AND INELASTICALLY SCATTERED DEUTERONS FROM NEON. I. J. Van Heerden (Nuclear Physics Div. of the National Physical Research Lab., C. S. I. R., Pretoria). Nuclear Phys. 6, 55-61(1958) Mar. (2).

The elastic and inelastic differential scattering cross sections of deuterons from Ne^{20} have been measured using nuclear emulsions. The angular distribution of the deuterons inelastically scattered from the 1.63-Mev level, has been compared with the predictions of the nuclear and electrical interaction theories of deuteron scattering. (auth)

8140

INELASTIC SCATTERING OF 185 Mev PROTONS ON LITHIUM, BERYLLIUM, BORON AND NITROGEN. H. Tyrén and Th. A. J. Maris (Univ. of Uppsala). Nuclear Phys. 6, 82-6(1958) Mar. (2).

The measurements of the energy spectra of light nuclei have been continued. Targets consisting of natural isotopic mixture were bombarded with protons of 182-Mev average scattering energy. The measured spectra are shown and discussed. (A.C.)

8141

SMALL ANGLE SCATTERING OF 1.33 Mev AND 1.17 Mev GAMMA RAYS. A. Storruste and P. O. Tjøm (Univ. of Oslo, Blindern). Nuclear Phys. 6, 151-6(1958) Mar. (3).

The differential scattering cross section for gamma rays of energy 1.33 Mev and 1.17 Mev scattered by lead and copper at angles varying from 1° to 8° has been measured. The result is in fair agreement with the elastic scattering cross section calculated by the form factor method and the Hartree electron distribution. (auth)

8142

APPROXIMATE OPTICAL MODEL EXPRESSIONS FOR THE ELASTIC SCATTERING AND POLARIZATION OF FAST PROTONS BY NUCLEI IN THE FORWARD SCATTERING PEAK. H. S. Köhler (CERN, Geneva). Nuclear Phys. 6, 161-74(1958) Mar. (3).

It is pointed out that in the forward peak the elastic differential cross sections and polarization of fast protons or neutrons scattered from nuclei, when calculated from the usual nuclear optical model interaction, are not sensitive to the shape of the central well. On these grounds expressions have been derived that should represent the scattering from any plausible well shape and with which it is practically possible to obtain optical model parameters by handmachine calculation. The formulas may be of some guidance when electronic machine calculations are made. They are applied to a few cases. (auth)

8143

THE ELASTIC SCATTERING OF 30.5 Mev ALPHA-PARTICLES FROM Ni, Cu AND Au. L. Wayne Swenson, Ulrich Schindewolf, and N. S. Wall (Massachusetts Inst. of Tech., Cambridge, Mass.). Nuclear Phys. 6, 203-9 (1958) Mar. (3).

The angular distributions of 30-Mev alpha particles elastically scattered from Au, Cu, and Ni have been measured and compared to pure Coulomb scattering. A sensitive comparison of the Cu and Ni data was made by comparing the ratio of Cu to Ni from experiment to that which would be expected if diffraction scattering were the only contributing process. An absence of a significant compound elastic contribution is concluded. (auth)

8144

ANGULAR DISTRIBUTION OF ELASTICALLY SCATTERED 14.7 Mev NEUTRONS. S. Berko, W. D. Whitehead, and B. C. Groseclose (Univ. of Virginia, Charlottesville). Nuclear Phys. 6, 210-18(1958) Mar. (3).

The differential elastic scattering cross sections of 14.7 Mev neutrons have been obtained for Mg, Al, Ni, Cu, Pb, and Bi. The neutrons from the (d,t) reaction were scattered from cylindrical scatterers and were counted by a time of flight setup measuring $n-\alpha$ coincidences with 2.5×10^{-9} sec resolving time. The angular distributions thus obtained are compared with recent theoretical distributions from Livermore employing a potential which has a rounded real part, a surface imaginary part and a real spin-orbit coupling term. (auth)

8145

ON THE THEORY OF SCATTERING MEASUREMENTS IN NUCLEAR EMULSION. II. THE ESTIMATION OF TRUE SCATTERING IN THE PRESENCE OF DISTORTION. N. Solntseff (Univ. of Sydney). Nuclear Phys. 6, 222-51 (1958) Mar. (3).

The effect of distortion on the scattering measurements in nuclear emulsion is here evaluated theoretically. The Molière-d'Espagnat method for estimating true scattering in the presence of experimental errors is extended to the case when third or fourth differences of the coordinates are used. The expressions for the relative standard error of the estimates of scattering from third and fourth differences are derived. The distortion is assumed to be of second order but the treatment can be easily extended to any regular type of distortion. It is found that an unbiased estimate can also be obtained for a distorted track by Fowler's method of eliminating distortion, in which the algebraic mean second difference is subtracted from each of the D_i. However, the relative standard error of such an estimate will in general be larger than the error of an estimate obtained from third and fourth differences. In the measurement of particles with pv greater than 1 Gev the bias introduced by distortion can be appreciable and third or fourth differences should be used. (auth)

8146

TABLES OF AVERAGE NUMBERS FOR ELECTRON-PHOTON SHOWERS AT SMALL DEPTHS OF ABSORBER. J. C. Butcher, B. A. Chartres, and H. Messel (Univ. of Sydney). Nuclear Phys. 6, 271-81(1958) Mar. (3).

Accurate numerical results for the average numbers of electrons and photons at small depths of absorber, in an electron-photon shower, have not hitherto been available.

Results are now presented for the average numbers in approximation A, for small depths. The calculations were performed using the digital computer Silliac. (auth)

8147

ON THE ELASTIC SCATTERING OF PIONS BY DEUTERONS. B. H. Bransden and R. G. Moorhouse (Glasgow Univ.). Nuclear Phys. 6, 310-18(1958) Mar. (3).

The elastic scattering of pions by deuterons is calculated for incident pion energies from 85 to 378 Mev. A variational method is employed which includes the effects of multiple scattering. Satisfactory agreement is obtained with experiment. For the pion-deuteron system the multiple scattering corrections turn out to be small but it is suggested that the method presented may be particularly suitable for future applications when multiple scattering effects are not small. (auth)

8148

FURTHER MEASUREMENTS ON n,p REACTIONS AT 14 Mev: Ti, Rh, Sn, Ta, Au AND ANGULAR DISTRIBUTION OF PROTONS EMITTED IN THE Ca (n,p) AND Ni (n,p) REACTIONS. L. Colli, U. Facchini, I. Iori, G. Maraczzan, and A. Sona (CISE, Milan) and M. Pignanelli (Univ. of Milan). Nuovo cimento (10) 7, 400-10(1958) Feb. 1.

The spectra of protons emitted by (n,p) reactions with 14 Mev energy neutrons on the medium weight and heavy elements: Ti, Rh, Sn, Ta, Au are presented. Angular distributions are also presented on the two elements: Ca, Ni. These spectra have been obtained by improving the technique already employed for lighter elements, which makes use of coincidence between scintillating and gas counters. (auth)

8149

SOLUTION OF BOLTZMANN EQUATION FOR MULTIPLE SCATTERING OF ELECTRONS. G. Molière (CERN, Geneva). Nuovo cimento (10) 7, 720-3(1958) Mar. 1.

8150

SCATTERING OF HIGH ENERGY ELECTRONS IN NUCLEAR EMULSION. Ahmad Husain (Dacca Univ., East Pakistan). Pakistan J. Sci. and Industrial Research 1, 37-9(1958) Jan.

In recent years the photographic emulsion technique has been applied to a variety of problems concerning nuclear studies, being useful because the tracks are permanent records, and results can be obtained in collisions of electrons involving small energy losses. The most rigorous mathematical treatment of electron-electron collision information has been done by Moller, and the results of experiments described here are compared using the Moller, Rutherford, and Mott equations for the theoretical cross sections of the scattering per electron. The experimental technique is presented along with a discussion of results. (J.R.D.)

8151

PROTON-PROTON SCATTERING AT MEDIUM-HIGH ENERGIES. Anwar Hossain (Dacca Univ., East Pakistan). Pakistan J. Sci. and Industrial Research 1, 40-4(1958) Jan.

Landau and Smorodinsky predicted a simple functional form for the variation of the nuclear phase shift with energy under very general assumptions about the nuclear potentials. Schwinger related the formula to the quantum mechanical properties of the system and explained the variation by parameters which predict the scattering properties of short and long tailed systems. The Landau–Smorodinsky–Schwinger approach to the proton–proton scattering problems is analyzed and developed. (J.R.D.)

8152

THE THEORY OF SMALL ANGLE SCATTERING FROM DISLOCATIONS. H. H. Atkinson and P. B. Hirsch (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 3, 213-28(1958) Mar.

The small angle scattering of x rays or neutrons from crystals containing a random network of dislocations is calculated. Three causes of density changes associated with dislocations are considered: that due to the elastic strain field from edge dislocations, that due to second-order elasticity effects and that due to the dislocation cores. It is found that in the range of angles for which experimental evidence is available, the effect due to the elastic strain field from edge dislocations predominates. The magnitude of the scattering expected from the theory for a dislocation density of about 10^{11} cm^{-2} is of the same order as that found recently from small angle neutron scattering experiments on heavily cold-worked copper. (auth)

8153

POLARIZATION OF ELECTRONS SCATTERED BY THIN GOLD FOILS. William G. Pettus (Univ. of Virginia, Charlottesville). Phys. Rev. 109, 1458-60(1958) Mar. 1.

The polarization of electrons by scattering from thin gold foils has been observed in a double-scattering experiment. The azimuthal asymmetry in the distribution of the twice-scattered electrons was measured in the energy range from 80 to 190 kev and for scattering angles of 60, 90, and 120 degrees. The observed asymmetries are somewhat smaller than would be expected from the calculations of Mohr and Tassie for the screened field of gold but the predicted increase in asymmetry for increasing scattering angles is confirmed. (auth)

8154

SCATTERING OF 12-Mev PROTONS, 24-Mev DEUTERONS, AND 48-Mev ALPHA PARTICLES BY BERYLLIUM. Robert G. Summers-Gill (Univ. of California, Berkeley). Phys. Rev. 109, 1591-1603(1958) Mar. 1.

A beryllium target has been bombarded with 12-Mev protons, 24-Mev deuterons, and 48-Mev alpha particles. With the three projectiles, the differential cross sections for inelastic scattering leading to the formation of the 2.43-Mev state have been measured. Application of inelastic-scattering theory leads to the assignment for this level, spin $^5/_2$ and odd parity. A very weak inelastic proton group has been found which could correspond to a level in Be^9 at ~1.8 Mev. The observation of inelastic alpha-particle groups corresponding to levels at 6.8 and 11.3 Mev makes definite the assignment of isotopic spin $^1/_2$ to these states. The data obtained are not inconsistent with the existence of levels at 3.1 and 4.8 Mev. The pickup reaction $Be^9(p,d)Be^8$ (ground state) was observed. Although the distribution is peaked forward as predicted by Butler, the shape is the same as that found at other energies. Such behavior is not consistent with the quantitative aspects of the theory. The reactions $Be^9(p,np')Be^8$ and $Be^9(\alpha,n\alpha')Be^8$ have been studied. Analysis of the angular distributions suggests that those processes in which the charged particle retains most of the energy occur predominantly by direct interaction. Finally, the elastic scattering of protons, deuterons, and alpha particles has been observed. Analysis of these distributions assuming a black nucleus gives reasonable agreement with the positions of the diffraction effects. The radii of interaction that are necessary are large but consistent within themselves and with those that fit the inelastic data. (auth)

8155

NEUTRON RESONANCES IN THE kev REGION: DIFFERENTIAL SCATTERING CROSS SECTIONS. Robert C. Block, Willy Haeberli, and Henry W. Newson (Duke Univ., Durham, N. C.). Phys. Rev. 109, 1620-31(1958) Mar. 1.

The ratio of the differential elastic neutron scattering cross sections for scattering by 180° and 90°, $R = \sigma_{nn}(180°)/$

σ_{nn} (90°), has been measured as a function of neutron energy between approximately 30 and 110 kev for F, Na, Mg, Al, K, V, Cr, Cu, Zn, As, Se, Sr, Zr, Nb, Mo, Ag, and Cd. When plotted against atomic weight, the average ratios $\bar{R}$ (averaged over the energy range of each element) exhibit peaks at A ≈ 90 and A ≈ 25, in qualitative agreement with the predictions of the complex square well potential model of the nucleus. However, the experimental ratios are in general larger than those predicted by the theory. Scattering from the lighter elements was also analyzed by single-level resonance theory and resulted in the following assignments: resonance in Al at 88 kev, $J = 3^+$; Mg (85 kev), $\frac{3}{2}^-$; Na (53 kev), 3^-; F (99 kev), 1^-; F (49 kev), 1^-; F (27 kev), 1^- or 2^-. These assignments are in good agreement with those obtained from the latest transmission measurements. (auth)

8156

COULOMB EXCITATION STUDIES USING INELASTICALLY SCATTERED PARTICLES. R. D. Sharp and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 109, 1698-1703(1958) Mar. 1.

Targets of samarium, terbium, and cadmium were bombarded with protons, and in one case with deuterons, of up to 7.0 Mev and the inelastically scattered particles were observed. In the rare earths, samarium and terbium, four previously known levels were studied: the 58- and 139-kev levels in Tb^{159}, the 80-kev level in Sm^{154}, and the 123-kev level in Sm^{152}. The excitation process was determined to be primarily Coulomb excitation up to 7.0 Mev, and the reduced transition probabilities were measured with a precision of approximately 10%. A test of the collective model was made by measurement of the ratios of the reduced transition probabilities to two excited states in the same nucleus, Tb^{159}. Eight levels were observed in cadmium. Two of them, at 585 and 641 kev, have not been previously reported. The absolute cross sections of the eight levels were determined with various angles of observation, incident energy, and type of bombarding particle. It was concluded that Coulomb excitation is a major contributor to the cross section at 6.0 Mev, and reduced transition probabilities were measured at this energy. (auth)

8157

TOTAL CROSS SECTION FOR THE REACTION $p + p \rightarrow \pi^+ + p + n$ AT 437 Mev. T. H. Fields, J. G. Fox, J. A. Kane, R. A. Stallwood, and R. B. Sutton (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 109, 1713-15(1958) Mar. 1.

The total cross section for the reaction $p + p \rightarrow \pi^+ + p + n$ has been measured for 437-Mev incident protons. The value obtained is 1.06 ± 0.24 mb, which is lower than some earlier measurements have indicated. The present result gives better agreement with the value predicted by the phenomenological theory and the measured cross section for $p + p \rightarrow \pi^+ + d$. (auth)

8158

NEUTRAL PIONS FROM PROTON-PROTON COLLISIONS. R. A. Stallwood, R. B. Sutton, T. H. Fields, J. G. Fox, and J. A. Kane (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 109, 1716-22(1958) Mar. 1.

The production of neutral pions in p-p collisions has been measured from 346 to 437 Mev. The method was to detect single photons at laboratory angles of 30, 60, and 90° from the decay of neutral pions in the reaction $p + p \rightarrow \pi^0 + p + p$. Total cross sections which were obtained in this experiment and previous results for proton energies near threshold, have an energy dependence consistent with the phenomenological theory. Additional data were obtained on neutral pion production in proton bombardment of several complex nuclei from Li to Pb. A cross section for bound neutrons was obtained by a comparison of results from H_2O and D_2O targets. (auth)

8159

PION PRODUCTION IN PION-NUCLEON COLLISIONS. R. M. Sternheimer and S. J. Lindenbaum (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 109, 1723-33(1958) Mar. 1.

The single production of pions occurring in pion-nucleon collisions at incident pion energies below ~ 1.5 Bev has been considered in terms of the inelastic excitation of the nucleon to the isobaric state with isotopic spin and angular momentum = $\frac{3}{2}$, previously identified with the resonant state in the low-energy pion-nucleon scattering. An associated separate recoil pion accompanies the isobar, and conserves energy and momentum. The isobar subsequently decays into a nucleon and a pion. Expressions have been obtained for the branching ratios between the different reactions, $\pi^- + p \rightarrow \pi^- + \pi^+ + n$, and $\pi^- + \pi^0 + p$, and for the separate energy spectra of the π^+, π^0, and π^- mesons. The momentum distributions of the pions and recoil nucleons have been calculated at incident pion energies of 0.93 Bev and 1.37 Bev, and are generally in reasonable agreement with the experimental data available at these energies. (auth)

8160

INTERACTIONS OF 38- AND 61-Mev POSITIVE PIONS IN DEUTERIUM. A. M. Sachs, H. Winick, and B. A. Wooten (Columbia Univ., New York). Phys. Rev. 109, 1733-49 (1958) Mar. 1.

Measurements have been made of the reactions (1) $\pi^+ + d \rightarrow \pi^+ + d$, (2) $\pi^+ + d \rightarrow \pi^+ + n + p$, and (3) $\pi^+ + d \rightarrow p + p$ at incident pion lab energies of 38 and 61 Mev using a liquid deuterium target and scintillation counters. A separation of the three processes is obtained by determining the mass and energy of reaction products using a pulse-height analysis technique on the signals from the scintillation counters. Results from process (3) are compared with other processes involving two nucleons and a meson and results from processes (1) and (2) are compared with impulse approximation calculations. (auth)

8161

SCATTERING OF 37-Mev POSITIVE PIONS ON HYDROGEN. A. M. Sachs, H. Winick, and B. A. Wooten (Columbia Univ., New York). Phys. Rev. 109, 1750-4(1958) Mar. 1.

Measurements have been made of the differential scattering cross sections of positive pions on hydrogen at 37 Mev using a liquid hydrogen target and scintillation counters. Scattered pions are separated from other particles in the background by measuring the mass and energy of the particles using a pulse-height analysis on the signals from the scintillation counters. A partial wave analysis is made of the experimental results assuming S- and P-wave scattering. The results obtained are $\alpha_3 = -4.11 \pm 1.09$ deg, $\alpha_{33} = 3.12 \pm 0.79$ deg, and $\alpha_{31} = -0.32 \pm 0.73$ deg. (auth)

8162

YIELD AND ANGULAR DISTRIBUTION OF FAST PHOTONEUTRONS FROM DEUTERIUM AND CARBON. P. S. Baranov, V. I. Gol'danskii, and V. S. Roganov (P. N. Lebedev Physical Inst., Academy of Sciences, Moscow). Phys. Rev. 109, 1801-6(1958) Mar. 1.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5041.

8163

FORM OF SCATTERING AMPLITUDE FOR TWO SYSTEMS OF ARBITRARY SPINS. Richard H. Capps (Univ. of Washington, Seattle). Phys. Rev. 109, 1823-9(1958) Mar. 1.

A general expression for the elastic scattering amplitude of two systems of arbitrary spins is derived in terms of the particle spin operators and momenta. Invariance under space and time translations and space rotation is assumed.

Time-reversal and space-rotation invariances are shown to require certain terms of the derived expression to be zero. Two cases are considered; the scattering of two systems of finite mass, and the scattering of a massless particle from a system of finite mass. (auth)

8164

NEUTRON-PROTON SCATTERING IN THE ENERGY RANGE 70 TO 170 Mev. T. C. Griffith, A. P. Banford, M. Y. Uppal, and W. S. C. Williams (Univ. Coll., London). Proc. Phys. Soc. (London) 71, 305-24(1958) Mar.

The angular distributions of neutrons scattered by protons at effective energies of 96, 130, and 157 Mev and at angles between 19.3° and 78.1° in the center-of-mass system have been measured using photographic emulsions. The differential cross sections have been normalized to the absolute scale by deducing the energy spectrum of the neutrons. The results confirm that at 130 and 137 Mev the cross sections for scattering at angles within 60° of the forward direction in the center-of-mass system are less than those for a similar range of angles in the backward direction. (auth)

8165

THE ELASTIC AND INELASTIC SCATTERING OF PROTONS BY SILICON. G. W. Greenlees, L. G. Kuo, J. Lowe, and M. Petravić (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 71, 347-50(1958) Mar.

Absolute differential cross sections are given for the elastic scattering by silicon of 9.45, 9.28, 8.96, 8.55, and 7.97 Mev protons for an angular range of 15 to 156° (center-of-mass coordinates). The angular distributions show characteristic maxima and minima, the patterns varying slowly with energy as might be expected for scattering by a complex potential. Absolute differential cross sections for the inelastic scattering of protons at these five energies from the 1.78 Mev level of Si^{28} are also given. All the inelastic angular distributions are asymmetric about 90° with a forward peaking. The magnitude of the asymmetry varies with energy and is greatest at 8.96 Mev. (auth)

8166

THE ČERENKOV EFFECT IN COMPOSITE (ISOTROPIC) MEDIA. A. M. Sayied (Inst. of Nuclear Physics, Calcutta). Proc. Phys. Soc. (London) 71, 398-404(1958) Mar.

The Cherenkov radiation emitted by a fast charged particle moving through one medium and in the vicinity of another medium has been theoretically investigated, employing the invariance of the phenomenological electrodynamic equations of Maxwell. A simple geometry has been considered, this being the case of two coaxial dielectrics and permeable cylinders with a common cylindrical interface and a charged particle moving along their common axis. The results obtained have been discussed with special reference to the case of Cherenkov radiation at microwave and radio-frequency regions. The effect of the phenomena of coherence on the output of the emitted radiation in these cases has been briefly outlined. (auth)

8167

MANY LEVEL SCATTERING IN FOCK SPACE. I. II. III. F. M. Medina Nicolau (Instituto de Fisica de la Universidad Nacional de Mexico e Instituto Nacional de la Investigacion Cientifica). Rev. mex. fis. 2, 43-62(1954). (In Spanish)

The time-dependent description of the many level scattering is discussed. The interaction is assumed to take place through the formation of a compound nucleus, and the description is given in an appropriate Fock space. In particular the Hamiltonian of the problem is derived and the quantum mechanical representation of the potential is given, this potential having no classical analog. (auth)

8168

DISPERSION RELATIONS FOR THE SCATTERING OF π MESONS BY DEUTERONS. F. Kaschluhn (Vereinigten Institut für Kernforschung Dubna bei Moskau (UdSSR)). Z. Naturforsch. 13a, 183-94(1958) Mar. (In German)

The dispersion relations for the elastic forward scattering of charged and neutral μ mesons by deuterons was derived neglecting electromagnetic reactions. The following differences appeared in the comparison with the scattering of μ mesons by free nucleons. The scattering amplitude is symmetric in the isotope spin indices of the μ mesons, and identical dispersion relations are obtained for the scattering of positive, negative, and neutral μ mesons. The total unobservable range gives a continuous yield so that no terminal yield appears. The flux matrix element with respect to the deuteron system almost diverges in the whole unobservable range so that an explicit carrying through of the analytic process is necessary so that the Bogoliubov method was transformed. The specific polarization effect with respect to the deuteron spin appeared. Under the form of the flux matrix element plausible assumptions were made in the necessary non-relativistic range of the nucleon motion, and the calculations were made in such detail that a comparison with experimental data was possible. (tr-auth)

Radiation Effects

Refer also to abstract 8235.

8169 AFOSR-TN-58-125

Ohio State Univ. Research Foundation, Columbus.

SOME OPTICAL AND MAGNETIC PROPERTIES OF IRRADIATED LiF. R. T. Bate and C. V. Heer. Jan. 1958. 21p. RF Project 582. Contract [AF]18(600)-1003. (AD-152152).

The optical oscillator strength of the F-band in LiF is determined as $f_L = 0.82$ from combined optical and magnetic measurements on x-irradiated and neutron irradiated samples. The number of F-centers formed in LiF as a function of neutron dosage was measured over a broad range of dosage by either optical or magnetic techniques. The formation of F-centers saturates in the vicinity of 8×10^{19} centers/cm^3; and saturation occurs for neutron dosages considerably smaller than required for saturation of vacancies and interstitials. Experimental evidence is presented to indicate that F-centers are separated by more than 6 lattice units in the most densely colored samples. (auth)

8170 KAPL-1727

Knolls Atomic Power Lab., Schenectady, N. Y.

RADIATION EFFECTS IN LiF. P. Senio and C. W. Tucker, Jr. May 24, 1957. 39p. Contract W-31-109-Eng-52. $1.00(OTS).

The physical stability of LiF was investigated as a function of neutron exposure, irradiation temperature, and other variables. Irradiation temperature has a pronounced influence on the initial rates of change of neutron radiation effects. The initial rate of lattice parameter expansion at 30°C is ~200 times the extrapolated rate at 185°C; x-ray line broadening is much more extensive at 30°C. The rate of dimensional growth and the ultimate dimensions also depend on irradiation temperature. Macroscopic fragmentation by cleavage occurs along (100) planes in large single crystals especially during irradiation at 30°C. The homogeneity of radiation effects accounts for the physical stability of small particles of LiF while polycrystalline compact samples resist macroscopic fragmentation because of grain boundaries and random grain orientation. Physical breakdown may also result because fluorine gas,

liberated during neutron exposure, may react with moisture to increase the internal gas pressure in samples. The x-ray lattice parameter and the line shapes of x-ray reflections may be restored to normal by thermal treatment but the former is restored at lower temperatures. The independence of irradiation temperature on the saturation value of the lattice parameter and the difference in the temperature at which the lattice parameter recovers, indicate that irradiation at different temperatures produces different defects. Bleaching of neutron-induced coloration in single crystals requires a thermal activation energy of 2.3 ev. This energy is determined from the temperature dependence on the rate of motion of a color interface which appears to move as crystal bleaching progresses. Gross expansion, distortion, and even fragmentation is observed in samples during treatment at elevated temperatures. The agglomeration of gaseous nuclear disintegration products is presumed to be responsible for crystal turbidity and bubbles which form and grow with planar shapes at temperatures above 600°C. (auth)

8171 NARF-58-9T

Convair, Fort Worth, Tex.

EFFECT OF NEUTRON IRRADIATION ON THE CRITICAL SHEAR STRESS OF A METAL SINGLE CRYSTAL. C. E. Morgan. Mar. 20, 1958. 62p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-192).

A mechanism is postulated to account for the change in the critical shear stress of a metal single crystal upon irradiation. This mechanism is based on a lattice defect consisting of interlocking dislocation rings. The dislocation rings are formed by plastic deformation of the matrix around thermal or displacement spikes in the metal, as suggested by Seitz. They remain in the lattice after irradiation to impede the movement of slip dislocations. From this model, an expression for the critical shear stress of a metal single crystal as a function of radiation dose is derived. The expression predicts that the critical shear stress varies as the cube root of the integrated neutron flux. The variation (after irradiation) of the critical shear stress with temperature is also discussed from the standpoint of this mechanism. Other radiation-hardening mechanisms (viz., interaction of slip dislocations with interstitials and vacancies, formation of stacking faults or agglomerations of interstitials and vacancies and formation of jogs on dislocations) are discussed and the dislocation ring mechanism compared with them. The agglomerated point defect or stacking fault mechanism and the dislocation ring mechanism differ in that, while the former requires diffusion of interstitials or vacancies before the irradiated metal is hardened, the dislocation ring method predicts that metals will be hardened by radiation even at the lowest temperature without warning. To test the theory, the critical shear stress of copper was calculated for neutron doses up to 2×10^{19} nvt. The calculated values agree quite well with available experimental data on irradiated high-purity copper crystals. Extension of the theory of polycrystalline metals and alloys is also discussed. (auth)

8172

EVIDENCE OF THE FORMATION OF LITHIUM IN A LITHIUM FLUORIDE CRYSTAL IRRADIATED WITH X RAYS. Mirianne Lambert and André Guinier. Compt. rend. 246, 1678-80(1958) Mar. 17. (In French)

Lithium was identified in two crystalline forms, simple cubic and face-centered cubic forms. It was verified that the diffraction centers disappear when the lithium fluoride is heated to a temperature higher than the melting point of lithium. (tr-auth)

8173

LOW-TEMPERATURE THERMAL CONDUCTIVITY IN NEUTRON IRRADIATED VITREOUS SILICA. Anna Foner Cohen (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 29, 591-3(1958) Mar.

Measurements of the thermal conductivity, K, of vitreous silica have been made at low temperatures before and after fast neutron bombardment. The observed increase of K upon bombardment is in agreement with the prediction of Klemens. Over the exposure range used, K increases approximately linearly with dose to the level used (6×10^{19} n/cm^2) whereas the density appears to have nearly saturated, suggesting that the two properties are not directly related. A possible explanation for the K increase upon bombardment is that the neutron bombardment relieves macroscopic strains. Alternatively, it is possible that bombardment causes an increase in local order in the vitreous material. (auth)

8174

DIELECTRIC BREAKDOWN OF KCl CRYSTALS IRRADIATED WITH γ RAYS. Yoshio Inuishi and Tokuo Suita (Osaka Univ., Japan). Phys. Rev. 109, 1509(1958) Mar. 1.

Irradiation with γ rays causes marked changes in the dc dielectric strength of KCl crystals both with and without illumination with visible light, whereas the impulse dielectric strength is not significantly changed. The results are ascribed to space charge and electron trapping. (auth)

Radioactivity

8175

CALCULATION OF THE CORRECTIONS FOR THE ANALYSIS OF THE β-SPECTRA AND THEIR APPLICATION TO Ho^{166}. G. Alaga and B. Jakšić. Glasnik Mat. Fiz. i Astron. 12, No. 1-2, 31-74(1957).

It is possible to account qualitatively for the large log ft = 8.1 value and approximately allowed shape of the $Ho^{166} \rightarrow Er^{166}$ ground state transition by a tensor pseudoscalar mixture. The following have been investigated: the case of destructive interference of pseudoscalar and tensor coupling in which the pseudoscalar plays the dominant role and the case of a singular tensor matrix element. The shape of the β spectrum of the $Ho^{166} \rightarrow Er^{166}$ ground state ($0^- \rightarrow 0^+$) transition and the branching to the first excited state (2^+) have also been investigated. Corrections due to the variation of the lepton wave functions over the nucleus have also been taken into account, and it is shown that under certain conditions these corrections can be sufficient to explain the experimental findings. (W.D.M.)

8176

THE INFLUENCE OF THE PSEUDOSCALAR INTERACTION IN THE DECAY OF Pr^{144}. G. Alaga, L. Šips, and D. Tadić (Prirodoslovno-matematički fakulet i Inst. »Ruder Bošković«, Zagreb). Glasnik Mat. Fiz. i Astron. 12, No. 3, 207-17(1957).

The influence of the pseudoscalar interaction in the β transition of ground state Pr^{144} to ground state Nd^{144} is investigated. The experimental values are fitted to an allowable Fermi plot using a smaller psuedoscalar coupling constant and a larger correction factor. (W.D.M.)

8177

THE ELECTRON-NEUTRINO ANGULAR CORRELATION IN DECAY OF Ne^{23}. B. W. Ridley (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 6, 34-49(1958) Mar. (2).

The electron-neutrino angular correlation in decay of Ne^{23} has been determined by measuring the distribution of electron energies and recoil momenta without selection of angle. The angular correlation parameter α was found to be -0.05 ± 0.10. This implies a ratio of coupling strengths of the axial vector and tensor parts of the Gamow-Teller interaction within the limits $0.85 \leqq |C_A|/|C_T| \leqq 1.62$. (auth)

8178

MESONIC EFFECTS IN BETA-DECAY. J. S. Bell (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and R. J. Blin-Stoyle (Clarendon Lab., Oxford). Nuclear Phys. 6, 87-99(1958) Mar. (2).

It is found impossible to give a consistent account of mirror transitions involving nuclei with LS-closed cores plus or minus one particle in terms of conventional beta-decay theory and using shell model wave functions. Possible explanations of the discrepancies are discussed, and it is concluded that there is some evidence for mesonic effects of an exchange character. (auth)

8179

BETA-NEUTRINO-GAMMA ANGULAR CORRELATION. M. Morita (Columbia Univ., New York). Nuclear Phys. 6, 132-4(1958) Mar. (2).

8180

HALF-LIVES OF THE POSITON EMITTING MIRROR NUCLIDES. S. E. Arnell, J. Dubois, and O. Almén (Chalmers Univ. of Tech., Goteborg). Nuclear Phys. 6, 196-20(1958) Mar. (3).

The half lives of the positron emitters C^{11}, N^{13}, F^{17}, Na^{21}, Al^{25}, Al^{26}, and P^{30} have been determined. The decay spectrum of Al^{25} has been investigated. No evidence for γ rays indicating a complex decay was found. A plot of log $T_{1/2}$ against log $A^{1/3}$ is discussed in terms of shell effects. It is shown that individual lines can be drawn through the points belonging to successive proton sub-shells. The value for Ne^{19} falls below the line representing the $d_{3/2}$-subshell, which somewhat favors the proposal that the ground states of Ne^{19} and F^{19} are $2s_{1/2}$-states. From a plot of the β^+ energies the pairing energy difference seems to have a value of about 0.1 Mev in the $d_{3/2}$-subshell. (auth)

8181

POSSIBLE DETERMINATION OF THE SPIN OF Λ^0 FROM ITS LARGE DECAY ANGULAR ASYMMETRY. T. D. Lee and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 109, 1755-8(1958) Mar. 1.

General consideration of the angular distribution of the decay products of a hyperon into a pion and a nucleon is carried out for arbitrary values J of the hyperon spin. Limitations on the magnitude of the asymmetry in the angular distribution are found. These limitations are formulated in terms of certain test functions which when applied to experimental results may lead to an unambiguous determination of the value of the hyperon spin. These considerations and the large "up-down" asymmetry in Λ^0 decay reported in recent literature suggest that the spin of Λ^0 is $\frac{1}{2}$. (auth)

8182

ABSOLUTE ASSAY AND STUDY OF SHORT-LIVED RADIONUCLIDES BY A RECOIL TECHNIQUE. F. S. Rowland and R. L. Wolfgang (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 29, 210-14(1958) Mar.

A new type of accelerator target has been used to determine the yield of He^6 from high-energy nuclear reactions. In this target the nuclear recoil of the product isotope separates it from the target material and carries it into a "catcher" gas which is then swept into a counter. Because of the design principle employed in this target, the data can be translated directly into absolute cross sections without explicit knowledge of the recoil properties of the product. This type of system may also prove useful in the determination of (1) the relative stopping powers of gases, (2) the rate of thermal diffusion of product species through the target material, and (3) the chemical properties of short-lived species of large kinetic energy. (auth)

8183

ON THE ANGULAR CORRELATION OF THE 72 kev/136 kev $\gamma-\gamma$ CASCADE OF Re^{187}. H. J. Behrend and H. Neuert (Physikalischen Staatsinstitut, Hamburg). Z. Naturforsch. 13a, 208-11(1958) Mar. (In German)

The angular correlation of the 72 kev/136 kev $\gamma-\gamma$ cascade of the deformed nucleus Re^{187} was measured. The coefficients A_2 and A_4 confirm the theoretically predicted spin sequency $^5/_2+ \rightarrow {}^7/_2+ \rightarrow {}^3/_2+$ for the lower three levels and lead by a pure E2 transition of 72 kev to an E2 mixture of 1.5% maximum in the 136 kev M1 transition. (tr-auth)

Rare Earths and Rare-earth Compounds

Refer also to abstract 7764.

8184

FERROMAGNETIC RESONANCE AND NONLINEAR EFFECTS IN YTTRIUM IRON GARNET. R. C. Lecraw, E. G. Spencer, and C. S. Porter (Diamond Ordnance Fuze Labs., Washington). J. Appl. Phys. 29, 326-7(1958) Mar.

A study of ferromagnetic resonance at 9300 Mc and 3000 Mc in single crystals of yttrium iron garnet is described. Cavity perturbation techniques are used with polished spherical samples 9 to 11 mils in diameter. The line widths along the hard axis [100] are found to be 2.3 and 5.7 oe, respectively, at 9300 Mc and 3000 Mc. It is believed the 2.3 oe is the narrowest resonance line yet observed on spheres of ferromagnetic material at room temperature. Because of the narrow line widths, the nonlinear behavior of these crystals is of particular interest. A 9300 Mc the rf field, h_{crit}, for saturation of the main resonance line is 46 millioersteds. Using Suhl's spin wave theory of nonlinear effects in ferromagnets, the 46 millioersteds (associated with a z-directed spin wave) predicts a spin-lattice relaxation time T_1 of 7.4×10^{-8} sec, in good agreement with the 7.0×10^{-8} sec measured by other independent methods. This T_1 then predicts an "intrinsic" line width of 1.54 oersted. Thus the observed line width of these crystals at 9300 Mc is within a factor 1.5 of its theoretical limiting value. At 3000 Mc, where the subsidiary resonance coincides with the main resonance, h_{crit} is 5.0 millioersteds (associated with spin waves not z directed). As the temperature is increased toward 340°K, an interesting effect is observed. The h_{crit} rises quite abruptly; in fact it changes by 10.5 db between 335°K and 340°K. This and other observations are compared with Suhl's nonlinear theory with good results. (auth)

8185

SUBSTITUTION FOR IRON IN FERRIMAGNETIC YTTRIUM–IRON GARNET. M. A. Gilleo and S. Geller (Bell Telephone Labs., Inc., Murry Hill, N. J.). J. Appl. Phys. 29, 380-1(1958) Mar.

In yttrium–iron garnet, iron may be entirely replaced by aluminum and gallium; chromium, scandium, and indium may be substituted for iron to a limited extent. Substitution proceeds on a steric basis for the nonmagnetic ions: Al^{3+} and Ga^{3+}, which are smaller than Fe^{3+}, preferentially occupy the smaller, tetrahedrally coordinated positions, 24(d); the Sc^{3+} and In^{3+} ions, which are larger than Fe^{3+}, preferentially occupy the larger, octahedrally coordinated positions, 16(a). The Cr^{3+} ion, though smaller than Fe^{3+}, preferentially occupies the octahedral position, presumably because of its electronic configuration. The magnetic moment initially increases with octahedral substitution and decreases with tetrahedral substitution. The Curie temperature is decreased by the

substitution of nonmagnetic ions for iron as a consequence of the decrease in the number of Fe^{3+}-O^{2-}-Fe^{3+} interactions. (auth)

8186

SPIN-LATTICE RELAXATION TIME IN YTTRIUM IRON GARNET. R. T. Farrar (Diamond Ordnance Fuze Labs., Washington). J. Appl. Phys. 29, 425-6(1958) Mar.

The spin-lattice relaxation time in yttrium iron garnet (YIG) has been measured by a pulsed ferromagnetic resonance method similar to that of Bloembergen and Wang and Damon, in which the z component of magnetization is directly observed. A microwave pulse with 2×10^{-8} sec rise and decay time, 5×10^{-7} sec long, and 2 w peak power is applied to a TE_{102} rectangular cavity operating at 9300 mc sec. The z component of magnetization M_z changes at the beginning and at the end of the rf pulse. The time of decay of the changing M_z signal at the trailing edge of the pulse (at which time the applied rf field is zero) is a measure of the spin-lattice relaxation time. A spherical sample of YIG, 0.03 in. diam, is placed in a quartz tube, 0.05 in. o.d., about which a five turn coil of No. 38 wire is wound. The coil with sample is inserted in the center of the cavity with the axis of the coil in the z direction. At this position, the rf magnetic field is maximum and the electric field is a minimum. The presence of the coil does not measurably change the properties of the cavity. The voltage induced in the coil is proportional to the change in M_z and is observed on a high speed oscilloscope. The time constant of the equipment is approximately that of the exciting pulse. Thus the spin-lattice relaxation time can be accurately determined directly if it is appreciably larger than this value. The ferromagnetic resonance line width is 2.3 oersteds and the measured spin-lattice relaxation time is 7×10^{-8} sec. (auth)

8187

FERRIMAGNETIC RESONANCE IN GADOLINIUM IRON GARNET. B. A. Calhoun, W. V. Smith, and J. Overmeyer (I. B. M. Corp., Poughkeepsie, N. Y.). J. Appl. Phys. 29, 427-8(1958) Mar.

Ferrimagnetic resonance in single crystals of gadolinium iron garnet has been observed at 9479 and 23 725 mc. Crystals from two different preparations have different compensation points, (13° and 32°C). The resonance behavior is discussed in terms of a two sublattice theory. g_{Gd} is equal to 2.006 above −90°C and increases at lower temperatures. The gadolinium ions contribute to the anisotropy below −40°. An extra resonance observed near the compensation point is attributed to inclusions in the crystals. The gadolinium apparently contributes substantially to the total damping of the magnetization. (auth)

8188

FERROMAGNETIC RESONANCE IN YTTRIUM IRON GARNET AT LOW FREQUENCIES. E. G. Spencer, R. C. LeCraw, and C. S. Porter (Diamond Ordnance Fuze Labs., Washington). J. Appl. Phys. 29, 429-30(1958) Mar.

Single crystals of yttrium iron garnet (YIG) exhibit the narrowest resonant line of all known ferromagnetic materials, being as low as 2.3 oe for the full width at half height for polished spheres at 9300 mc. Ferromagnetic resonance on polished YIG disks was observed at frequencies as low as 44 mc, for an applied dc field of 1000 oe. Conversely, resonance was observed for fields as low as 300 oe, for a frequency of 2000 mc. Nonlinear effects in ferromagnetic materials can be evidenced by the excitation of unstable spin wave modes, such as were discovered at x band by Bloembergen and his colleagues. In their case the dc fields required for this subsidiary resonance were approximately one half that required for resonance of uniform precession. When measurements are made on a sphere at a frequency low enough so that $H_{res} < 8\pi M_s/3$, Suhl's theory shows that the dc field required for the minimum threshold of the subsidiary resonance is identical with that required for resonance of the uniform precession. In this case the critical rf fields required are particularly low being given in terms of the line width to an order of magnitude as $h_{crit} = \Delta H^2/4\pi M_s$. Measurements have been made of h_{crit}, for the subsidiary resonance as a function of frequency for polished single crystal spheres of YIG. Based on a $4\pi M_s$ of 1725, the frequency below which coincidence of the uniform precession and subsidiary resonances occur, is 3220 mc. Below 1610 mc the dc fields for resonance are insufficient to saturate the sphere and domains are formed. Values are given for h_{crit}, spin-wave angle θ, and spin-wave number k for frequencies of 1610 to 3220 mc. At 2200 mc a min in h_{crit} occurs. At this frequency h_{crit} = 2.0 millioersteds, the power incident on the cavity is 20 microwatts and the power absorbed by the sample is of the order of a microwatt. The experimental results are discussed in terms of Suhl's theory. (auth)

8189

MICROWAVE PROPERTIES OF POLYCRYSTALLINE RARE EARTH GARNETS. M. H. Sirvetz and J. E. Zneimer (Raytheon Mfg. Co., Waltham, Mass.). J. Appl. Phys. 29, 431-3(1958) Mar.

A number of garnets including yttrium garnet, $Y_3Fe_5O_{12}$, and mixed garnets of the forms $(Y_{1-\alpha}Sm_\alpha)_3Fe_5O_{12}$ and $(Y_{1-\beta}Gd_\beta)_3Fe_5O_{12}$ have been prepared. X-band ferromagnetic resonance and saturation magnetization have been measured as a function of temperature. At room temperature samarium substitution for yttrium produces an approximately linear increase of line width with samarium content with practically no change in magnetization. Gadolinium substitution, on the other hand, has a much smaller effect on line width but produces an approximately linear decrease in saturation magnetization. Possible microwave application of these materials is discussed. (auth)

8190

FERRIMAGNETIC RESONANCE IN SINGLE CRYSTALS OF RARE EARTH GARNET MATERIALS. R. V. Jones, G. P. Rodrigue, and W. P. Wolf (Harvard Univ., Cambridge, Mass.). J. Appl. Phys. 29, 434-5(1958) Mar.

The preliminary results of a study of the ferrimagnetic resonance properties of single crystals of rare earth iron garnet containing samarium, gadolinium, dysprosium, holmium, erbium, and ytterbium are presented. The measurements have been conducted in the temperature region from 77°K to 550°K at microwave frequencies in the x band. The effective g values and line widths are consistent with the previously reported measurements on polycrystalline samples. In this temperature region the anisotropy energy of the Sm, Gd, Er, and Yb crystals can be represented by the usual cubic form with a negative first order term. The line widths exhibit a large anisotropy which increases with decreasing temperature. (auth)

8191

MAGNETIC PROPERTIES OF DYSPROSIUM SINGLE CRYSTALS. D. R. Behrendt, S. Legvold, and F. H. Spedding (Iowa State Coll., Ames). Phys. Rev. 109, 1544-7(1958) Mar. 1.

Single crystals of metallic dysprosium have been grown by the Bridgman method and their magnetic properties have been determined in different crystallographic directions of the hexagonal close-packed structure. Below the Néel point of 178.5°K the individual magnetic moments are aligned perpendicular to the c_0 axis. The moments are aligned in an antiferromagnetic manner from 178.5°K down to 85°K and in a ferromagnetic manner below 85°K. Measurements with the field parallel and perpendicular to the c_0 axis

reveal magnetic anisotropy at all temperatures. Below 110°K magnetic anisotropy is also observed in the basal plane. The direction of easy magnetization is along an a_0 axis. In the c_0 direction the crystals are extremely "hard" magnetically, the magnetization curves being linear as in the case of a paramagnetic material. The saturation moments follow the T^2 law. (auth)

8192

MAGNETIC PROPERTIES OF HOLMIUM AND THULIUM METALS. B. L. Rhodes, S. Legvold, and F. H. Spedding (Iowa State Coll., Ames). Phys. Rev. 109, 1547-50(1958) Mar. 1.

The magnetic moments of holmium and thulium metals have been measured in applied fields of 3000 to 18,000 oersteds, over the temperature range of 4.2 to 300°K. Holmium, paramagnetic above 133°K, appears to be antiferromagnetic between 20°K and 133°K, and ferromagnetic below 20°K. Thulium was found to be paramagnetic above 51°K and possibly antiferromagnetic below 51°K. (auth)

Shielding

8193 CF-52-5-1(Pt. 2)(Del.)

Oak Ridge National Lab., Tenn.

NEUTRON AND GAMMA DOSE DISTRIBUTION BEYOND BERYLLIUM–SOLID IRON SHIELD IN WATER. C. E. Clifford. Aug. 14, 1952. Decl. with deletions Apr. 19, 1957. 20p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The beryllium–solid iron–water measurements were taken to aid in determining the feasibility of eliminating the boron carbide in the high-temperature regions of primary and top plug shields. A solid iron layer beyond the beryllium would become less effective as a gamma shield with increasing thickness because of the excessive production of capture gammas in and beyond the slab. This would tend to increase the over-all shield weight somewhat over that for the boron carbide shield. Measurements were taken of both the gamma and neutron dose distribution beyond the iron in the beryllium, iron, water configuration. The measurements of the gamma dose indicate the iron is quite effective for a thickness up to 20 cm. As the thickness increases beyond 20 cm the apparent relaxation length becomes very long and eventually becomes longer than that for water, which causes the dose at a fixed distance from the source to increase with replacement of water with iron. The neutron dosage measurements were taken to aid in estimating the relative transmitted dose and radiation damage beyond the solid iron as compared with that in the boron carbide design. (A.C.)

8194 CF-52-5-1(Pt. 3)(Del.)

Oak Ridge National Lab., Tenn.

GAMMA ATTENUATION OF LEAD IN TOP PLUG MOCKUP NO. 1. C. E. Clifford. June 26, 1952. Decl. with deletions Apr. 19, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

An attempt was made to measure the gamma attenuation of lead in the beryllium–iron–water configuration. This configuration is a mockup of a top plug design which replaced all B_4C in the bottom section of the plug with solid iron. The iron was followed by sufficient water to remove most of the low-energy neutrons, which would cause capture gammas in the subsequent lead gamma shielding. Neutron measurements indicated the amount of water used was sufficient. Unfortunately the observed gamma intensity was too low to allow reliable measurements of the attenuation of more than one slab; however, the data for two slabs are presented as obtained. (A.C.)

8195 CF-52-5-1(Pt. 4)(Del.)

Oak Ridge National Lab., Tenn.

NEUTRON AND GAMMA DOSE DISTRIBUTION BEYOND VARIOUS SECTIONS OF TOP PLUG MOCKUP NO. 2 (BERYLLIUM, SOLID IRON, BORON CARBIDE, WATER, AND IRON–WATER MIXTURE). C. E. Clifford. Aug. 6, 1952. Decl. with deletions Apr. 17, 1957. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Top plug mockup 2 was the first experimental check of the initial top plug design using B_4C in a thick layer in the high-temperature region of the plug. Thick mockup included the 20-in. B_4C slab which contained occluded water in an unknown amount due to improper storage. Since the water is very effective in removing the intermediate energy neutrons which would normally have penetrated the B_4C and would have been captured in the iron layers following it, the mockup gives an underestimate of the capture gamma source in the iron–water layers. An attempt was made to estimate the effect of the water in the 20-in. B_4C slab by eliminating water from between the iron slabs. Since the iron appears to be as effective as could be expected and no increase in the gamma dose was noted upon the elimination of 20 cm of water in the iron–water mixture, it is concluded that capture gammas in this design are not a significant fraction of the measured gamma dose. The measurement of the gamma dose was very difficult since the radiation from the source was less than the background. The neutron dose could not be measured directly with the dosimeter because of the low intensity. The thermal flux was used to estimate the fast neutron dose on the basis of a previous comparison with the dosimeter reading in a pure water shield where the neutron relaxation length was between 7 and 9 cm. Since other measurements have indicated that for neutron relaxation lengths as short as those prevalent beyond this mockup, this procedure overestimates the dose by roughly an order of magnitude; therefore, the reported dose is felt to be a conservative upper limit. (A.C.)

8196 CF-52-5-1(Pt. 5)(Del.)

Oak Ridge National Lab., Tenn.

NEUTRON AND GAMMA DOSE DISTRIBUTION BEYOND PRIMARY SHIELD MOCKUP NO. 2 (BERYLLIUM, SOLID IRON, WATER, AND SOLID IRON). C. E. Clifford. July 17, 1952. Decl. with deletions Apr. 19, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Since the gamma attenuation of the first primary shield mockup was greater than required, a second mockup was tested which contained less iron. Also the B_4C layer was eliminated since it was a difficult material to handle in the shield and was not particularly advantageous at this location. The B_4C was initially present to reduce capture gamma production and radiation damage in the region requiring high-temperature shielding material, i.e., close to the reactor. It was found, however, that solid iron would suffice for this region and was preferred from the engineering point of view. (A.C.)

8197 CF-52-5-1(Pt. 7)(Del.)

Oak Ridge National Lab., Tenn.

NEUTRON AND GAMMA DOSE DISTRIBUTION BEYOND TOP SHIELD FOR VARIOUS WATER THICKNESSES IN PRIMARY SHIELD MOCKUP NO. 2. C. E. Clifford. Aug. 8, 1952. Decl. with deletions May 19, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The neutron and gamma dosage distributions were measured as a function of the water thickness in the primary shield in order to estimate the contribution to the total dose by capture gammas produced within the top shield. (A.C.)

8198 CF-52-5-1(Pt. 9)(Del.)
Oak Ridge National Lab., Tenn.
NEUTRON AND GAMMA DOSE DISTRIBUTION BEYOND VARIOUS SECTIONS OF TOP PLUG MOCKUP NO. 3 (BERYLLIUM, SOLID IRON, IRON–BORON CARBIDE MIXTURE, SOLID IRON). C. E. Clifford. July 17, 1952. Decl. with deletions Apr. 19, 1957. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Based on information obtained from earlier experiments and further engineering study, a final design of the top plug was made in which the B_4C layer was reduced in thickness and replaced with solid iron in the inner regions. The thickness of the iron and B_4C was chosen to reduce the radiation damage in the water following the layers to a tolerable limit. The actual shield design stipulated a 40% Fe–60% H_2O mixture for the region beyond the B_4C layers. (A.C.)

8199 CF-52-5-1(Pt. 10)(Del.)
Oak Ridge National Lab., Tenn.
NEUTRON AND GAMMA DOSE DISTRIBUTION BEYOND TOP PLUG MOCKUP NO. 3 WITH MOCKUP OF STRUCTURAL MEMBER (SOLID IRON MODIFIED TO 47% IRON–53% WATER. C. E. Clifford. Aug. 4, 1952. Decl. with deletions Apr. 17, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The design of the removable top shield plug necessarily incorporated rather massive structural members of solid steel which penetrated straight through the shield, thus allowing a leakage path for intermediate energy neutrons. A partial mockup of the worst case, the 4 in. shell of steel surrounding the plug, was installed in the Lid Tank to determine the order of magnitude of the leakage problem. The results of the test were not encouraging. The presence of the 4-in. solid steel layer increased the emerging flux by an order of magnitude over the unperforated shield for only 13 in. of perforation. Since the results of this experiment were not encouraging, a further investigation was made for many configurations of solid steel ducts in a water shield and are reported in Part II of this memorandum. (A.C.)

8200 CF-52-5-1(Pt. II)(Del.)
Oak Ridge National Lab., Tenn.
NEUTRON DOSE DISTRIBUTION BEYOND VARIOUS STRUCTURAL MEMBER MOCKUPS. C. E. Clifford. Oct. 4, 1952. Decl. with deletions May 19, 1957. 32p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

A series of experiments to determine the magnitude of neutron leakage from the steel structures which penetrate the top plug shield was done in the Lid Tank on the final part of the shield testing program. A series of mockups was constructed and installed in the Lid Tank. The mockups were built to simulate those features which were believed to represent the worst cases of streaming in the top plug design. The neutron traverses indicate roughly the size of a patch which would be required to adequately shield such weak spots in the shield. (A.C.)

8201 HW-55372
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NEUTRON ATTENUATION IN MAGNETITE CONCRETE HEATED TO 200°C. D. E. Wood and E. G. Peterson. Mar. 25, 1958. 15p. Contract [W-31-109-Eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

The relaxation length for fast neutron in magnetite concrete heated to 200°C is 9.74 cm, compared to 9.52 cm after heating to 100°C, and 8.75 cm before heating. The largest change in relaxation length occurred as a result of heating to 100°C. It appears that at or below 100°C, the concrete loses more water than in subsequent heating steps. Attempts to confirm the water loss by weighing the slabs were not accurate enough to be conclusive, although definite weight losses occurred during each heating. (auth)

Theoretical Physics

8202 NYO-6486 MH-V
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
THEORY OF MAXWELL'S EQUATIONS WITHOUT DISPLACEMENT CURRENT. Magneto-Hydrodynamics Note No. V. A. A. Blank, K. O. Friedrichs, and H. Grad. Nov. 1, 1957. 147p. Contract AT(30-1)-1480. $22.80 (ph OTS); $7.20(mf OTS).

A general descriptive survey is presented of the electromagnetic theory, which existed prior to Maxwell's introduction of the concept of displacement current, which is aimed primarily at applications in fluid magnetics. (W.D.M.)

8203 NYO-7903
Princeton Univ., N. J. Project Matterhorn.
THE GYRATION OF A CHARGED PARTICLE. Martin Kruskal. Mar. 12, 1958. 14p. Contract AT(30-1)-1238. (PM-S-33). $3.30(ph OTS); $2.40(mf OTS).

The equations of motion of a charged particle tightly gyrating in a given electromagnetic field are expanded asymptotically to all orders in the radius and the period of gyration. The existence of an adiabatic invariant (essentially the "magnetic moment" of the particle or equivalently the amount of flux encircled by its orbit), proved to lowest order by Alfvén and to the next order by Hellwig, is proved to all orders. The invariant is obtained explicitly to the lowest two orders. The method can be applied to prove the existence of an adiabatic invariant to all orders for a large class of Hamiltonian systems with conventional lowest order adiabatic invariants. (auth)

8204
NUCLEAR MAGNETIC RESONANCE IN A THREE-NUCLEON SYSTEM. A. Corciovei and M. Mugur. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 267-94(1957). (In Romanian)

In this work, a three-nuclei-system, each nucleus with a $\hbar/2$ spin, the positions of which are parametrically given by their position vectors, is taken into consideration. By studying the stationary states, the energy levels of the system, in the constant magnetic field $\mathcal{H}_0$, are determined. The hamiltonian of the system is divided into two terms: the fundamental hamiltonian H^0, including Zeeman's term and that part of the dipolar term that contains the elements for which $\Delta S_z = 0$ (where S_z is the magnetic quantic total spinning number); and the perturbation hamiltonian H^1, containing the remainder of the dipolar term elements and the exchange term. In this way, the level values are obtained more accurately than by other scientists. The transition probabilities in a weak oscillating magnetic field, normal to $\mathcal{H}_0$ are also determined. A more accurate calculation is done and for the transitions $\Delta S_z = \pm 1$, three other groups of very low intensity are found, in addition to the four groups' lines of high intensity. It is also shown that the lines for which $\Delta S_z = 0 \pm 2$ are not absolutely forbidden, as some authors had established, though they are of a low intensity, of about $(D/Z)^2$ with regard to the high-intensity lines. (auth)

8205
THE NUCLEAR MAGNETIC ABSORPTION IN A THREE-NUCLEON SYSTEM FORMING AN EQUILATERAL TRIANGLE. A. Corciovei. Acad. rep. populare Romîne, Inst. fiz. Studii cercetari fiz. 8, 295-309(1957). (In Romanian)

Nuclear magnetic resonance in a three-nucleon system, in which the nucleons form an equilateral triangle, is studied. The stationary state of the system in a constant magnetic field is investigated, and it is shown that the level values, corrected by consideration of a dipole perturbation of the second order and an exchange perturbation of the first order, are dependent, aside from the universal constant and the field value, only on the angle that the normal to the triangle plane makes with the field and on the distance between the nucleons. The situation is the same for the transition probabilities. The absorption curve of an aggregate of independent three-nucleon systems is studied with isotropic orientation in space. (tr-auth)

8206

REMARKS ON CERTAIN PROPERTIES OF WEAK INTERACTIONS. Bernard d'Espagnat and Jacques Prentki. Compt. rend. 246, 1505-8(1958) Mar. 10. (In French)

Recently a general theory of weak interactions was developed by the introduction of a new isotopic space obtained from the dimensional isotopic spin. The general frame of this space can be used to elaborate a more precise theory based on well defined Lagrangians. The purpose of the present article is to show it is possible to add certain terms to the Lagrangians which do not modify the results but only introduce some disintegrations of types difficult to detect experimentally. (J.S.R.)

8207

THE CPT THEOREM IN THE THEORY OF STABLE AND QUANTIZED EXCITED STATES OF RELATIVISTIC FLUID MASSES IN ROTATION. Pierre Hillion. Compt. rend. 246, 1508-10(1958) Mar. 10. (In French)

The non-invariance of the structure of relativistic drops is established by comparison to each of the CPT operations taken separately. The invariance is shown by comparison to the three successive operations. Interesting results are deduced for particle reactions. (tr-auth)

8208

IMPROVEMENT OF THE BORN APPROXIMATION FOR DIFFUSION BY A POTENTIAL WELL WITH SPHERICAL SYMMETRY. Michel Fabre de la Ripelle. Compt. rend. 246, 1511-13(1958) Mar. 10. (In French)

8209

NON LOCAL INTERACTIONS AND THE DIFFUSION MATRIX. Khosrow Chadan. Compt. rend. 246, 1513-16 (1958) Mar. 10. (In French)

It is shown how, in an interaction which is the sum of a local interaction and a separate non-local interaction, the non-local part can be determined from the local part and the diffusion matrix. (tr-auth)

8210

CONSTRUCTION OF A SOLUTION WITH MOBILE SINGULARITY OF THE EQUATIONS OF THE NEUTRINO WITHOUT EXTERIOR FIELD. Thiounn Mumm. Compt. rend. 246, 1673-4(1958) Mar. 17. (In French)

The solution of the equation of a neutrino without an exterior field is constructed by the utilization of a line potential having linear singularity of mobile punctuality on an arbitrary trajectory. (J.S.R.)

8211

FERROMAGNETIC DYNAMICAL RESPONSE. Herbert B. Callen (Univ. of Pennsylvania, Philadelphia). J. Appl. Phys. 29, 333-4(1958) Mar.

A dynamical equation, describing the response of the magnetization to an applied field, is proposed. The analysis is based on a spin-wave picture. The dynamical equation contains three parameters, defined in terms of particular magnon-magnon and magnon-phonon transition probabilities. A more detailed theory for one of these parameters is developed. The resultant size and shape dependence of the magnetic loss is suggestive of experimental observations. (auth)

8212

DAMPING AND THE DISPERSION RELATIONS IN ANTIFERROMAGNETIC RESONANCE. E. S. Dayhoff (U. S. Naval Ordnance Lab., Silver Spring, Md.). J. Appl. Phys. 29, 344-5(1958) Mar.

The tensor susceptibility of an antiferromagnetic with uniaxial anisotropy has been calculated using several modifications of the Bloch damping term. The axial component of the susceptibility is particularly simple and is readily tested by the Kronig-Kramers dispersion relations as modified by Gourary. It is found that, of the damping terms considered, only one which includes relaxation to the instantaneous equilibrium magnetizations will pass this test. (auth)

8213

INTERACTION OF THE GENERAL VECTOR FIELD WITH THE ELECTROMAGNETIC FIELD AND COMPARISON WITH THE FIELD OF MAXIMUM SPIN 1 OF THE FUSION THEORY. K. H. Tzou (Inst. Henri-Poincaré, Paris). J. phys. radium 19, 119-21(1958) Feb. (In French)

In the absence of external fields, the spin states 1 and 0 have no mutual interaction in the case of the general vector field as in the case of the field of maximum spin 1 of the fusion theory. The interaction with an electromagnetic field makes evident the interference effect of the two spin states of the first field, while the spin states of the second remain always independent with no mutual interference. The electromagnetic interaction shows therefore clearly the physical difference between the two fields as concerning their internal structure with regard to spin states. (auth)

8214

THE GRAVITON IN THE FUNCTIONAL THEORY OF PARTICLES. Jean-Louis Destouches (Inst. Henri-Poincaré, Paris). J. phys. radium 19, 135-9(1958) Feb. (In French)

The fundamental equations for the particle of maximum spin 2 (graviton) in the fundamental theory of particles are given. The transformation and explicit equations are derived. The physical fields of a particle of maximum spin 2 are described, and their equations derived and classified into sub-systems. (J.S.R.)

8215

ON THE "NEUTRINO CHARGE" IN WEAK AND STRONG INTERACTIONS. M. Konuma, S. Nakamura, and H. Umezawa (Univ. of Tokyo). Nuclear Phys. 6, 282-6 (1958) Mar. (3).

It is proposed to extend the idea of the neutrino charge of the leptons to all the elementary particles. No experiments have been found to contradict the assumption that parity is conserved when the neutrino charge is and that the neutrino charge changes by a constant in any process due to the weak interactions in which the conservation of the parity is violated. It is likely that the neutrino charges of the baryons and mesons can be assigned to be the same as their hypercharges. (auth)

8216

A THEOREM ON POTENTIALS WITH HARD CORES. G. H. Derrick (Univ. of Sydney). Nuclear Phys. 6, 287-94 (1958) Mar. (3).

It is shown for quite general systems of particles that a potential with a hard core gives the same binding energy in the limit of vanishing core radius as the corresponding potential with no hard core at all. (auth)

8217

ON THE VALIDITY OF LEVINSON'S THEOREM FOR NON-LOCAL INTERACTIONS. A. Martin (Univ. of Paris. Nuovo cimento (10) 7, 607-27(1958) Mar. 1.

By introduction of an artificial boundary condition on the one dimensional S wave function it is possible to compare the number of eigenstates of a non-local Hamiltonian to the number of free eigenstates, provided the free and interacting eigenstates tend to coincide at high energies. Orthogonality of the wave functions, plus certain auxiliary hypotheses, enable one to prove the inequality $\delta(0)-\delta(\infty) \geq \nu\pi$, where ν is the number of bound states. At first sight, the completeness of the eigenstates of the non-local Hamiltonian, which is proved for well behaved interactions, seems to be sufficient to establish the inequality $\delta(0)-\delta(\infty) \leq \nu\pi$ and, by comparison with the previous inequality, the theorem of Levinson, which says that the difference $\delta(0)-\delta(\infty)$ is equal to π times the number of bound states. However, one must take into account a possible degeneracy of the wave function for a positive energy. This fact, which never happens with a local regular potential, slightly modifies Levinson's theorem. It turns out that the difference $\delta(0)-\delta(\infty)$ is equal to π times the total number of eigenstates with vanishing asymptotic form, among which some states may have a positive energy. Application of these results to the Low equation is discussed. (auth)

8218

MASS REVERSAL AND WEAK INTERACTIONS. J. J. Sakurai (Cornell Univ., Ithaca, N. Y.). Nuovo cimento (10) 7, 649-60(1958) Mar. 1.

An attempt is made to construct a theory of all weak processes from a single invariance principle. The requirement that the weak interaction Hamiltonian be invariant under the reversal of the sign of the mass in the Dirac equation separately for any fermion field leads to a unique form of the four-fermion interaction responsible for weak processes. The Hamiltonian contains equal amounts of V and Ar, and is necessarily invariant under time reversal but non-invariant under parity regardless of whether or not the neutrino field is involved. (The results are identical to those obtained by Feynman and Gell-Mann and by Sudarshan and Marshak using somewhat different approaches.) The possible existence of an intermediate charged boson field responsible for all weak processes is discussed with reference to several weak processes which have not been observed. Most experiments in β decay and the π-μ-e sequence are consistent with the predictions of the theory with the important exception of the He^6 recoil experiment. Various implications of the theory which can be experimentally tested are examined with special attention to the decay interactions of hyperons and K mesons. (auth)

8219

VARIATIONAL PRINCIPLES FOR THE WAVE FUNCTION IN SCATTERING THEORY. Saul Altshuler (Ramo-Wooldridge Corp., Los Angeles). Phys. Rev. 109, 1830-6 (1958) Mar. 1.

Variational principles are designed for the solution of the Schroedinger equation when a point source is placed in the presence of an inhomogeneous, absorbing medium represented by an arbitrary complex potential function. When the point source is allowed to recede to infinity, these stationary structures reduce to variational principles for the wave function in the standard scattering problem, namely the outgoing solution to the Schroedinger equation for an incident plane wave. Finally in the asymptotic region, the well-known bifunctional variational principles for the transition amplitudes arise automatically from the stationary forms for the wave function describing the standard scattering problem. A few examples leading to variationally improved wave functions are discussed. (auth)

8220

PERMUTATION SYMMETRIES OF GENERALIZED BETA INTERACTIONS. R. Finkelstein (Univ. of California, Los Angeles). Phys. Rev. 109, 1842-5(1958) Mar. 1.

The permutation symmetries of the even and the odd beta couplings are investigated for 2^n-rowed spinors. In the usual four-rowed case there are two quadratic forms which are independent of the order of writing the spinors. In the usual even case there are $\Sigma\, C_\sigma^4 |g_\sigma|^2$ and $|g_S + 4g_A - g_P|^2$; in the odd case, $\Sigma\, C_\sigma^4 |u_\sigma|^2$ and $\frac{1}{2}|u_S + u_P|^2 + 6|u_T|^2$. For eight-rowed spinors with even couplings there are two completely antisymmetric forms; with odd couplings there is again only one. (auth)

8221

USE OF THE CHEW-LOW EQUATION IN STRONG COUPLING. C. J. Goebel (Univ. of Rochester, N. Y.). Phys. Rev. 109, 1846-8(1958) Mar. 1.

In charged scalar fixed-point-source theory, the isobar energies and scattering amplitudes in the strong-coupling limit are derived by extending the Serber-Lee solution with the aid of perturbation arguments. (auth)

8222

ADMISSIBLE SOLUTIONS OF THE COVARIANT TWO-BODY PROBLEM. F. L. Scarf (Univ. of Washington, Seattle) and H. Umezawa (Univ. of Tokyo, Japan). Phys. Rev. 109, 1848-53(1958) Mar. 1.

The spectrum of Wick's two-body problem is examined with respect to normalization conditions and the assumptions made in deriving the equation. The problem is considerably simplified by using a formalism based on Sakata-Taketani field operators. It is found that the spurious state amplitudes (suitably normalized) have a behavior inconsistent with the assumptions used by Gell-Mann and Low to derive the bound-state equation. Similar results are found for the two-fermion problem if the vertex operator is $(1 + \gamma_5)$, and it is suggested that all spectra of the Bethe-Salpeter equation contain only three quantum numbers. (auth)

8223

CHIRALITY INVARIANCE AND THE UNIVERSAL FERMI INTERACTION. E. C. G. Sudarshan (Harvard Univ., Cambridge, Mass.) and R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Rev. 109, 1860-2(1958) Mar. 1.

Tritium and Tritium Compounds

8224 AFOSR-TR-58-51

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies. TRITIUM ASSAYS OF NATURAL WATERS MEASURED IN 1956-1957. F. Begemann. Dec. 31, 1957. 71p. Contract AF18(600)-564. (AD-154131).

Measurements on the tritium content of precipitation and surface waters have been continued. As it was anticipated that noticeable amounts of tritium would be produced during the U.S. test series of thermonuclear weapons during May-July 1956, arrangements were made ahead of time to collect precipitation in various places in the Northern Hemisphere in order to obtain more detailed information on the distribution of the "excess" tritium. Data are presented for Chicago (Illinois), Bern (Switzerland), Reykjavik (Iceland), and various locations in the Arctic. In addition, the tritium content of Mississippi water has been measured continuously to study its relationship to the tritium content of precipitation. The tritium content of one set of annual layers of snow from Greenland covering the period from 1944-1956 was measured to obtain the amount of CASTLE and REDWING produced tritium deposited in this particular area as well as the natural production rate of tritium. The results on three more sets of snow samples from the Antarctic confirmed

the previous finding that no detectable amounts of bomb tritium are deposited in this area. Finally, to further investigate the usefulness of tritium for the study of hydrological problems, the measurements on samples from Steamboat Springs, Nevada, have been continued. The results of the measurements and their interpretation are presented. (auth)

Uranium and Uranium Compounds

8225 AECD-4261
[Los Alamos Scientific Lab., N. Mex.]
THE VALUE OF NU FOR FISSION OF U^{233} BY 14 MEV NEUTRONS AS DERIVED FROM CHARGE DISTRIBUTION MEASUREMENTS. John Wahl. [nd]. Decl. Apr. 7, 1958. 13p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40 (mf OTS).

The charge distribution for fragments from fission of U^{235} induced by 14 Mev neutrons, as given by Ford, was examined to obtain the average number of neutrons per fission. On the basis of some assumptions which seem reasonable, a value $NU = 5.2 \pm 0.5$ is obtained. Some evidence is also given which points toward the validity of the Glendenin hypothesis of charge distribution as opposed to that of Present. (auth)

8226 UCRL-4975
California. Univ., Livermore. Radiation Lab.
CRITICAL MASSES OF SPHERICAL SYSTEMS OF ORALLOY REFLECTED IN BERYLLIUM. H. Robert Ralston. Oct. 10, 1957. Decl. Feb. 26, 1958. 7p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The critical thickness of beryllium reflector was determined for oralloy (uranium, enriched to 93.17% U^{235}) spheres ranging from 10.765 kg to 32.654 kg. Four points which were determined by other experimenters were normalized to the data and are included in the curves. (auth)

PATENTS

Chemistry

8227
RADIOCHEMICAL PREPARATION OF COPOLYMERS OF MALEIC-ANHYDRIDE AND OLEFINIC MATERIALS. (to Esso Research and Engg. Co. (U. S. A.)). Nuclear Eng. 3, 186(1958) Apr.

The materials are exposed to a radiation of at least 10,000 R/h until polymerization is effected. Suitable types of radiation include gamma rays, X-rays, beta rays, alpha particles. High-intensity gamma radiation used include nuclear fission by-products, materials made radioactive by neutron radiation are preferred.

8228
PROCESS FOR REDUCING ACIDITY OF NITRIC ACID SOLUTIONS CONTAINING METAL SALTS. T. V. Healy (to U. K. Atomic Energy Authority). British Patent 784,609. Nuclear Eng. 3, 186(1958) Apr.

In the processing of aqueous nitric acid solutions of chemical substances (fission products), wherein reduction of the bulk of the solutions is carried out by evaporation, the concentration of the nitric acid may become undesirably high. It has been found that in a solution in which the nitric acid concentration does not exceed 8N the following reaction takes place with formaldehyde: $-3\ CH_2O + 4\ HNO_3 \rightarrow 4\ NO + 3\ CO_2 + 5\ H_2O$, and nitric oxide is capable of decomposing nitric acid of concentration above 8N to produce nitrogen dioxide and water. Thus, the process of reducing the acidity is first carried out with a heated solution not exceeding 8N which is treated with formaldehyde, yielding nitric oxide which is passed into contact with a further solution of acidity above 8N to reduce this acidity.

8229
LUBRICANTS RESISTANT TO ATOMIC RADIATION. (to Esso Research and Engg. Co. (U. S. A.)). British Patent 784,793. Nuclear Eng. 3, 186(1958) Apr.

The new lubricant composition is a lubricating oil having incorporated therein a sufficient proportion of an element or compound having a gamma ray absorption coefficient of at least 3 and a sufficient proportion of an element or compound having a capture of at least 2,500 barns.

Mineralogy, Metallurgy, and Ceramics

8230
CERAMIC MATERIALS. W. J. Kramers, D. R. Whittaker, and W. B. Rotsey (to U. K. Atomic Energy Authority). British Patent 784,321. Nuclear Eng. 3, 186(1958) Apr.

Normal ceramics lack ductility and, in order to obtain this, heterogeneous metal-ceramic ("cermet") mixtures have been proposed. Continuous distribution of the metal phase is difficult to achieve, but it has been observed that metal-ceramic-distribution may be effected by the dissociation or splitting up of a chemical sub-compound or solid solution on cooling into metal and non-metal phases. A mixture of a refractory compound of a metal (thoria powder) and the metal (thorium metal powder) is heated to a high temperature in an inert atmosphere or in vacuo and then cooled. The proportions are so chosen that the product splits up into metal and non-metal phases (thoria powder 5.8 parts, thorium metal 19.8 parts).

8231
GLASS TO METAL SEAL. (to Atomic Energy of Canada, Ltd. (U. S. A.)). British Patent 784,375. Nuclear Eng. 3, 186(1958) Apr.

Palladium metal is widely used in chemical apparatus because it permits selective and rapid diffusion of hydrogen through itself, particularly when heated. Hitherto it has not been possible to connect the thin-walled palladium tube usually employed directly to the remainder of the apparatus made of soft glass due to the large difference between the thermal expansion coefficients and, therefore, a short platinum tube was inserted between the palladium and the glass. It has now been discovered that palladium can directly be secured to glass by means of a solder glass of low fusion point.

8232
URANIUM ALLOYS. P. C. L. Pfeil (to U. K. Atomic Energy Authority). British Patent 784,882. Nuclear Eng. 3, 186(1958) Apr.

Alloys of high-tensile strength at temperatures up to 800°C and increased resistance to oxidation as compared with uranium metal are made of uranium, molybdenum (10 to 20%) and zirconium (5 to 10%). The uranium may be enriched in the isotope U233 or U235.

Physics

8233

FUEL ELEMENTS FOR NUCLEAR REACTORS. K. H. Dent (to U. K. Atomic Energy Authority). British Patent 784,890. Nuclear Eng. 3, 186(1958) Apr.

At present, the principal factor limiting the maximum safe operating temperature in vertical fuel elements is the creep strength of the canning material, so that any design which removes load has merit. The load in this design is carried by a member having a creep strength superior to that of the canning, and is fixed so as to carry the stresses due to the weight of the fuel element. The carrying member is preferably made of a material having a low neutron absorption. In some cases this might not be the best solution and then the load carrier must have a small volume only (e.g., a pin screwed into the fuel element connected with an external support).

8234

NUCLEAR REACTOR HEATED BOILER SYSTEMS. R. V. Moore and W. R. Wootton (to Babcock and Wilcox, Ltd.). British Patent 785,050. Nuclear Eng. 3, 186(1958) Apr.

When a heat transferring liquid is circulated through a reactor and then through the boiler in closed circuit, it is desirable that the temperatures of the fluid entering and leaving the reactor are controlled. A simple form of control can be had by maintaining the outlet temperature with a speed controller on the circulators for the heat transferring liquid and by maintaining the inlet temperature with a pressure control valve on the boiler.

8235

IRRADIATED POLYETHYLENE AND PRODUCTS THEREFROM. (to General Electric Co. (U. S. A.)). British Patent 785,505. Nuclear Eng. 3, 186(1958) Apr.

Polyethylene which has been treated with high energy electrons and, in certain applications, maintained at elevated temperatures (125 to 175°C) continuously for very long periods, has shown a degradation as evidenced by a pitted surface and excessive flow. Further, when irradiated polyethylene has remained in contact with copper for 25 to 50 hours at such or higher temperatures, a reaction appears to occur causing "greening" of the copper. A green film develops on the surface which reduces the adhesion of the polyethylene to the copper core. Incorporation of stabilizers has been insufficient. The interposition of a resinous coating protecting the copper has solved the problem.